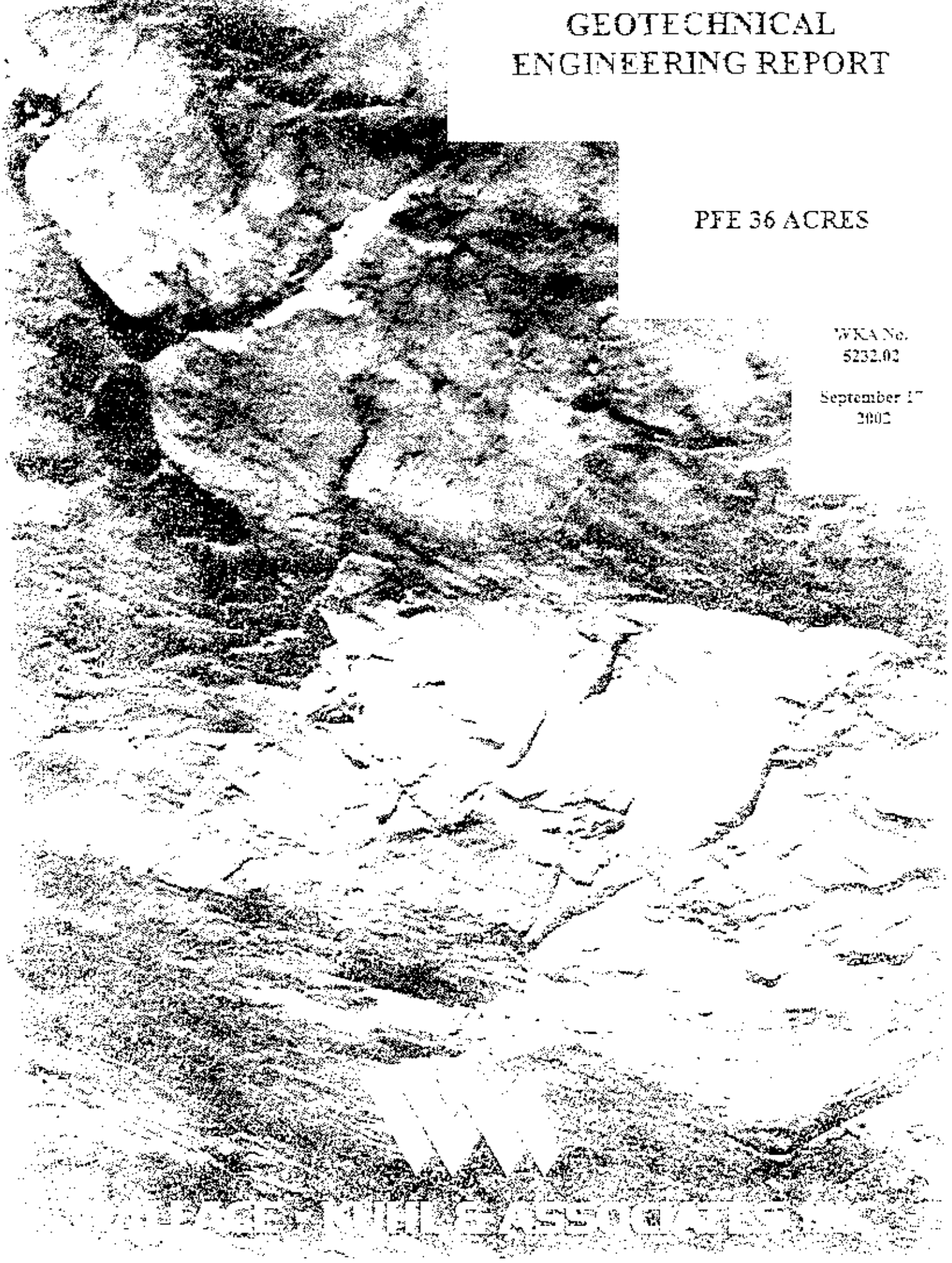
GEOTECHNICAL ENGINEERING REPORT

PFE 36 ACRES

WKA No.
5232.02

September 17
2002



WALLACE · KUHL
& ASSOCIATES INC.

Geotechnical Engineering Report

PFE 36 ACRES

PFE Road

Placer County, California

WKA No. 5232.02

September 17, 2002

INTRODUCTION

General

This report presents the results of our geotechnical engineering investigation for the PFE 36 Acre property located on PFE Road, west of Oly Lane in Placer County, California. The purposes of our work have been to explore the site, soil and ground water conditions across the property, and to provide geotechnical engineering conclusions and recommendations regarding development of the property with a single-family residential subdivision.

Scope

Our scope of work included the following tasks:

1. site reconnaissance;
2. review of historic USGS topographic maps and historical aerial photographs of the property;
3. subsurface investigation, including the drilling of six borings to a maximum depth of approximately 15 feet below the ground surface;
4. laboratory testing of selected soil samples; and
5. engineering analyses and preparation of this report.

Our office has performed several geotechnical engineering investigations in the surrounding area. Site and soil-related information contained in those reports was used to assist in preparation of this report.

CORPORATE OFFICE
[illegible]
West Sacramento
CA 95691
Tel: 916.372.1434
Fax: 916.372.2565

ROCKLIN OFFICE
[illegible]
Suite 100
Rocklin CA 95765
Tel: 916.435.8722
Fax: 916.435.8823

Plates and Attachments

This report contains a Site Vicinity Map, Plate No. 1; a Boring Location Plan, Plate No. 2; and, Logs of Borings, Plates No. 3 through 8. An explanation of the symbols and classification system used on the logs is included as Plate No. 9. Appendix A contains general information regarding project concepts, exploratory methods used during our field investigation, and laboratory test results not shown on the logs. Appendix B contains earthwork specifications that may be used in the preparation of contract documents.

Proposed Development

Based on our conversations with County Builders, we understand the approximate 36 acre property will be developed with a residential subdivision consisting of one- and two-story, wood-frame houses with slab-on-grade lower floors. Building loads typical of ordinary residential construction are assumed for the houses. Additional improvements will consist of roadways and underground utility improvements.

Grading plans are not available, but we anticipate maximum excavations and fills to develop the site on the order of 5 to 6 feet.

FINDINGS

Site Conditions

The subject property consists of gently to moderately rolling open grassland located just north of the Sacramento/Placer County line in Placer County, California. The property is bounded to the north by PFE Road; to the east by Oly Lane; to the south by a residential subdivision; and, to the west by a rural residence. Our review of historic aerial photographs and topographical maps indicates the property has remained relatively unchanged since the early 1960's. Based upon the topography from *USGS Topographic Map of the Citrus Heights Quadrangle, 1992,* site elevations range from approximately +120 feet to +130 feet mean sea level (msl).

At the time of our field exploration, the surface of the site was covered with a low to moderate growth of grasses and weeds. A naturally occurring drainage swale (approximately 10 feet wide) formed from the runoff of the adjacent residential subdivision, bisects the property running in an east-west direction. A larger swale approximately 20 feet wide runs along the western side of the property. Trees and shrubs were observed along the drainage swales. Within the southwestern portion of the site we observed miscellaneous concrete debris on the ground surface.

Soil Conditions

The test borings revealed the upper one to three feet to consist of light brown, stiff, clayey silts and medium dense, fine sandy silts. Underlying the surface soils were alternating layers of light brown, stiff to dense, clayey sands, silty sands and sandy silts to the maximum depth explored of 15 feet below existing site grades. These soils are sometime slightly to well cemented. In one boring, located near the drainage swale, we observed the presence of a layer of sandy clay near the surface.

Please refer to the Logs of Borings, Plates No. 3 through 8, for more detail regarding subsurface soil conditions.

Ground Water

Free ground water was not encountered within the 15-foot maximum depth of our borings performed on August 20, 2002. The current Sacramento County ground water map (published Spring 2000) indicates that the ground water beneath the area of the subject property is located at an elevation of approximately -20 feet msl, or roughly 140 to 150 feet below the existing site elevations.

CONCLUSIONS

Building Support

Field and laboratory test results indicate the undisturbed native soils are capable of supporting the proposed improvements. Portions of the surface soils near the concrete debris appear to be

disturbed; these soils will require thorough processing and recompaction during earthwork for support of engineered fills, foundations, slabs or pavements. In addition, clearing operations to remove trees likely will disturb the near surface soils. Disturbed areas must be excavated to a firm base and the excavations backfilled with engineered fill to provide adequate and uniform support for fills and structures.

Our work indicates that engineered fill, properly placed and compacted in accordance with the recommendations of this report, will be capable of supporting the planned residential structures.

Excavation Conditions

The test borings were drilled with a CME-55 drill rig, which encountered little difficulty penetrating the soils. Based upon this and our experience, conventional grading and trenching equipment will be able to perform the excavations required at the site within the depths explored.

Excavations likely will stand at a near-vertical inclination for short periods of time, unless zones or pockets of clean cohesionless sands are encountered or the construction is performed during the rainy season. Excavations encountering perched water or saturated soils may slough or cave if left open for an extended period of time. Excavations entered by workers must conform to current Cal/OSHA requirements (i.e., sloped or braced shoring). Temporarily sloped excavations should be constructed no steeper than one horizontal to one vertical (1:1).

Expansive Soils

The borings revealed clayey sands within a few feet of the surface. Laboratory tests indicate these soils have a low expansion potential (see Plate No. A1). In our opinion, these soils are capable of developing minor swelling pressures due to increases in soil moisture content. However, our experience in the area indicates that potential expansive clays are typically present above the cemented strata. If expansive clay soils are encountered and utilized to construct building pads or are present within excavated areas of building pads, special preparation during site grading, or presaturation of the soils subgrade prior to floor slab placement and reinforcement of floor slabs will be required to minimize the effects of expansive soils.

Pavement Subgrade Quality

Laboratory test results indicate the on-site soil conditions contain variable concentrations of silt and clay and typically such soils are lower quality materials for the support of asphalt concrete pavements. Laboratory tests indicate the near-surface soils possess a Resistance ("R") value of 13 (Plate No. A2). Based on our laboratory data and experience in the area, we utilized an R-value of 10 for design of pavements. Due to the possible variation of soils that may be exposed at final subgrade elevation, additional laboratory testing should be performed during construction to verify our design recommendations.

Fill Material Suitability

The on-site non-expansive soils encountered in our borings are considered suitable for use as engineered fill materials if they are free of debris and organic concentrations, and are at suitable moisture content. Special recommendations are contained in the Site Preparation and Engineered Fill Construction section of this report regarding the use of expansive clays in engineered fill.

Ground Water/Seasonal Moisture

In our opinion, a permanent ground water table should not be a factor in design, construction or performance of the proposed subdivision. However, during the winter and spring months, infiltrating surface run-off water will create saturated surface soil conditions due to the impervious nature of the underlying clays and cemented soils. It is probable that grading operations attempted following the onset of winter rains and prior to prolonged drying periods will be hampered by high soil moisture contents. Such soils, intended for use as engineered fill, will require a prolonged period of dry weather and/or considerable aeration to reach a moisture content suitable for proper compaction.

Seismic Code Design

The entire State of California is considered to be subject to ground shaking from numerous active fault systems across the state. Based on tables provided in the 1997 edition of the Uniform Building Code (UBC), the proposed development has the following site characteristics. The site

is located within Seismic Zone 3. The site soil conditions most closely approximate an S_D profile. The site is not located within 15 kilometers of an active or potentially active fault; therefore, near-fault effects will not be a factor in seismic design, nor is a seismic source type assigned using the 1997 UBC.

Erosion and Winterization

The on-site soils generally consist of silty sands, clayey sands and sandy silts. In our opinion, the undisturbed soils and fill materials consisting of on-site soils may be susceptible to erosion by surface run-off that occurs during intense rainfall. As a minimum, erosion control measures including placement of straw bale sediment barriers or construction of silt filter fences in areas where surface run-off may be concentrated would be prudent. The project civil engineer should develop a site-specific erosion and sediment control plan based upon their site grading and drainage plan and the anticipated construction schedule. The erosion and winterization measures contained in the publication *Erosion and Sediment Control Guidelines for Developing Areas of the Sierra Foothills and Mountains*, dated October 1991, would be appropriate for developing such a plan.

Soil Corrosion Potential

A sample of the near-surface soil was submitted to Sunland Analytical Lab, Inc. for testing to determine pH, resistivity, sulfate and chloride concentrations to help evaluate the potential for corrosive attack upon buried structures. The test results for the sample revealed minimum resistivity of 2200 ohm-centimeters (Ω-cm) with a soil pH of approximately 6.15. Sulfates were recorded at 5.0 parts per million (ppm) and chlorides at 13.2 ppm. Results of testing performed by Sunland Analytical Lab are summarized on Plate No. A2, in Appendix A.

Published data indicates soils with low resistivity values, typically less than 1000 Ω-cm, a chloride concentration greater than 200 ppm, a sulfate concentration greater than 150 ppm, or with a pH below 6.0, may significantly increase corrosion of reinforced concrete structures. Comparing this information to the test results indicates the native soils are not unusually corrosive to buried metal or to reinforcement steel properly embedded in concrete. Use of

concrete with a water/cement ratio of 0.6 or less along with a minimum three-inch cover over reinforcement steel may help to minimize the effects of corrosive soils. Use of Type I-II Portland cement would be appropriate at this site based upon the test results and published data.

Wallace-Kuhl & Associates are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site, or to determine the need or design parameters for cathodic protection or grounding systems a corrosion engineer should be consulted.

RECOMMENDATIONS

Grading plans for the project have not been developed yet; therefore, for the purposes of preparing this report we have assumed maximum excavations and fills of around 5 to 6 feet to develop the site. Additionally, we assume that most of the building pads will be constructed using native, granular soils, and building foundations will bear in granular engineered fill or non-expansive native undisturbed soils. However, it is possible that some building pads may contain expansive clay soils. When building pads expose expansive clay soils, the clays should be removed and replaced with on-site nonexpansive engineered fill, or the building pads will be designated as expansive which will require special moisture conditioning prior to slab placement.

We should review the final grading plans to verify that the recommendations of our report remain applicable.

Site Clearing

The site should be cleared of trees and larger vegetation designated for removal. Tree removal should include the rootball and all surface roots larger than ½-inch in diameter. The upper 12 inches of soil subgrades within areas of removed trees should be thoroughly cross-ripped to expose any remaining root structures or debris. All exposed remnants should be removed and debris and roots cleared from the site. Adequate removal of debris and tree roots may require laborers and hand-picking to clear the subgrade soils to the satisfaction of our on-site representative, prior to further site preparation.

Depressions resulting from clearing operations, as well as any loose, saturated, or organically contaminated soils, as identified by our representative, should be cleaned out to firm, undisturbed soils and widened, as necessary, to allow access with construction equipment. Depressions should be backfilled with engineered fill in accordance with the recommendations contained in this report.

Remaining surface vegetation should be removed by stripping. Strippings should be hauled from the site or used as fill only in backyard areas. Strippings used in backyards should be kept at least five feet from building pads. Strippings should be moisture conditioned, not exceed a vertical thickness of two feet and receive reason compactive effort. ***Discing may be a suitable alternate to stripping, depending upon the quantity and condition of the organics at the time of grading. Discing should be allowed only with our approval after review of the site conditions at the time of grading.***

Site Preparation and Engineered Fill Construction

After clearing and organic removal are completed to the satisfaction of our representative, the exposed soils in areas to receive fill and at-grade areas should be scarified to a depth of at least 12 inches, moisture conditioned to at least the optimum moisture content and compacted to at least 90 percent of the maximum dry density per ASTM D1557. Deeper scarification may be needed depending upon the depth of soil disturbance observed by our representative. Our representative will determine the need for the deeper scarification.

On-site soils are considered suitable for use in engineered fill construction, if free of significant concentrations of organic material, rubble or debris. Imported fill materials should be granular materials with non-plastic fines (Plasticity Index of 15 or less / Expansion Index of 20 or less), be free of particles greater than four inches in largest dimension. Imported soils must be approved by our office prior to being transported to the project site. Clay soils, exposed during site excavations may be used in deeper fills at the site, but should be excluded from the upper two feet of building pad fills, if possible.

Engineered fill should be placed in lifts not exceeding six inches in compacted thickness, with each lift being uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 90 percent relative compaction. Clay soils used in fill construction should be moisture conditioned to at least two percent above the optimum moisture content. All compaction should be based on the ASTM D1557 test standard.

The upper six inches of soil subgrade in pavement areas should be uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 95 percent relative compaction.

Lots achieved by excavation should be observed by our representative to determine whether clay soils are present. Expansive clay soils exposed at or within 12 inches of final building pad elevation should be removed and replaced with on-site granular soils placed and compacted as engineered fill. The bid documents should include a per yard unit price for additional excavation and replacement with engineered fill. If the clay soils are not removed from building pad subgrades, or if clays are used for fill within the upper two feet of the building pads, these building pads will be designated as expansive and will require special foundation and slab construction recommendations.

Site preparation should be accomplished in accordance with the recommendations of this section and the appended Earthwork Specifications (Appendix B). *It is essential that our representative be regularly present during the excavation, scarification and compaction operations to evaluate the proper compaction of the materials. Our representative also should be present throughout grading operations to observe and test the fill materials, as necessary.*

Foundation Design

Non-Expansive Building Pads

One- and two-story residential structures may be supported upon continuous and isolated spread foundations that extend at least 12 inches into the compacted building pad, as measured from lowest adjacent soil grade. For this project, the building pad subgrade is defined as the soil surface on which capillary break gravel is placed. A continuous, reinforced foundation should be

utilized for the perimeter of the structures to act as a "cut-off" to help minimize moisture infiltration and variations beneath the slab-on-grade areas of the structures. Continuous foundations should be at least 12 inches wide; isolated spread foundations should maintain a minimum 18-inch dimension.

Foundations bearing in undisturbed or recompacted native soils, engineered fill, or a combination of those materials may be sized for vertical loads utilizing maximum allowable soil bearing pressures of 1500 per square foot (psf) for dead load, 2250 psf for dead plus live load, or 3000 psf for total load, including the effects of seismic or wind forces. The weight of foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations.

We recommend that all foundations be adequately reinforced to provide structural continuity, mitigate cracking and permit spanning of local soil irregularities. The structural engineer should determine the foundation reinforcing requirements. However, *as a minimum*, we recommend that continuous foundations be reinforced with at least two No. 4 steel reinforcing bars, placed one each, near the top and bottom of the foundations.

Resistance to lateral displacement of shallow foundations may be computed using an allowable friction factor of 0.30 multiplied by the effective vertical load on each foundation. Additional lateral resistance may be achieved using an allowable passive earth pressure against the vertical projection of the foundation equal to an equivalent fluid pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

Expansive Building Pads

Foundations constructed on building pads containing expansive clays, as identified by our representative, should be designed using the same recommendations as for building pads constructed on non-expansive soils except that perimeter foundations should extend to at least 18 inches below lowest adjacent soil grade. Perimeter foundations should be continuous around the structure to form a cut-off wall foundation to minimize soil moisture variations beneath the structure.

Interior Floor Slab Support

Non-Expansive Building Pads

Concrete slabs-on-grade may be suitably supported upon soil subgrades prepared in accordance with the recommendations in this report. Interior concrete slab-on-grade floors should be a minimum of four inches thick; however, the structural engineer should determine final slab thickness and reinforcing based upon the anticipated floor loads. From a crack-control standpoint, a light gauge 6x6/W1.4xW1.4 welded wire fabric (in rolls) would be suitable for slab reinforcement; however, it has been our experience that it is more difficult to consistently locate the lighter gauge wire mesh at mid-slab depth. Accurate and consistent location of the reinforcement at mid-slab is essential to its performance and the risk of uncontrolled drying shrinkage slab cracking is increased if the reinforcement is not properly located within the slab.

Therefore, we recommend consideration should be given to using a heavier gauge 6x6/W2.9xW2.9 wire (flat sheets) placed on chairs, or No. 3 rebar at 24-inches each way in the slab.

The recommendations presented above are provided to help minimize soil-related cracking of slab-on-grade floors. Equally important to the performance and appearance of Portland cement concrete slabs is the quality of the concrete, the skill of the concrete contractor, curing techniques utilized and the spacing of control joints.

Expansive Building Pads

In addition to the above recommendations, slabs constructed on expansive soils should contain *at least* 6x6/W2.9xW2.9 welded wire mesh reinforcement or No. 3 rebar located on maximum 18-inch centers each way throughout the slab, to help minimize the effects of expansive clays. Location of the reinforcement at mid-slab is essential to its performance.

Floor slabs constructed on expansive soils must have the upper 12 inches of the soil subgrade brought to a near-saturated condition, prior to concrete slab placement. Adequate moisture conditioning must be verified by our office within 48 hours prior to slab placement. Use of the vapor barrier membrane is considered mandatory when presaturation is accomplished.

Floor Slab Moisture Penetration Resistance

It is considered likely that floor slab subgrade soils will become wet to near-saturated at some time during the life of the structures. This is a certainty when slabs are constructed during the wet seasons, or when constantly wet ground or poor drainage conditions exist adjacent to structures. For this reason, it should be assumed that all slabs in living areas, as well as those intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. Standard practice includes the gravel, plastic membrane and sand as suggested above. However, the gravel and plastic membrane offer only a limited, first line of defense against soil-related moisture. Recommendations contained in this report concerning foundation and floor slab design are presented as *minimum* requirements, only from the geotechnical engineering standpoint.

It is emphasized that we are not slab moisture-proofing or moisture protection experts. We are expressly stating that we make no guarantee nor provide any assurance that use of the sub-slab gravel and sheet plastic will reduce slab moisture penetration to any specific amount or level, particularly those required by floor covering manufacturers. The builder and designers should consider all available measures for slab moisture protection. It is commonly accepted that the quality and thickness of the concrete slab are of primary importance to reducing moisture and moisture vapor penetration.

Exterior Concrete Flatwork

Areas to receive exterior flatwork (sidewalks, patios, etc.) should be scarified, thoroughly moisture conditioned and properly compacted prior to placement of concrete. Uniform moisture conditioning of subgrade soils is important to reduce the risk of non-uniform moisture withdrawal from the concrete and the possibility of plastic shrinkage cracks. Practices recommended by the Portland Cement Association for proper placement and curing of concrete should be followed during exterior concrete flatwork construction. Flatwork should be independent of the building foundations and felt strips should be used to separate concrete slabs from adjacent existing concrete structures.

Trench Backfill

All utility trench backfill should be mechanically compacted in maximum 12-inch thick lifts. We recommend that only native soils be used as trench backfill within the perimeter of the building foundations to help minimize soil moisture variations beneath the structure. The native soil backfill should extend at least three feet beyond perimeter foundation lines.

Utility trench backfill and compaction, and pipe bedding and initial backfill of utility lines within County right-of-ways should conform with Placer County Standards and the pipe manufacturers recommendations.

Site Drainage

Final site grading should be accomplished to provide positive drainage of surface water away from the buildings and prevent ponding of water adjacent to foundations. The grade adjacent to the structures should be sloped away from the foundations at a minimum two percent slope for a distance of at least five feet, where possible. Roof gutter downspouts and surface drains should be connected to solid PVC piping and directed towards appropriate drainage facilities, or the downspouts should drain onto concrete surfaces sloping away from the structures.

Preliminary Pavement Design

Based on Resistance ("R") value testing, our experience in the area, and using a range of design traffic indices, we have calculated pavement section alternatives for a Resistance-value of 10. The procedures used for designing the pavement section are in general conformance with the "Flexible Pavement Structural Design Guide for California Cities and Counties" and applicable portions of the Caltrans Highway Design Manual. The project civil engineer should select the appropriate pavement sections based upon Placer County requirements. If higher quality soils are exposed at subgrade elevation thinner pavement sections will be adequate.

PAVEMENT DESIGN ALTERNATIVES R-value = 10		
Traffic Index (TI)	Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
5.0	2½	10
	3*	9
5.5	2½	12
	3*	11
6.0	2½	14
	3½*	12
6.5	3	15
	4*	13
9.0	4	22
	5½*	19

* includes the Caltrans factor of safety applied to the asphalt concrete thickness

We emphasize that pavement performance is critically dependent upon adequate and uniform compaction of the subgrade soils, as well as all engineered fill and utility trench backfill within the limits of the pavements. The upper six inches of pavement soil subgrade should be compacted to at least 95 percent relative compaction at a moisture content of at least the optimum moisture content. Aggregate base should be compacted to at least 95 percent maximum dry density.

Materials quality and construction within the structural sections should comply with Placer County Standards and applicable provisions of the Caltrans Standard Specifications.

Construction Testing and Observation

Geotechnical testing and observation services during construction is considered a continuation of our geotechnical engineering investigation. Wallace - Kuhl & Associates, Inc. should be retained

to provide testing and observation services during site grading, and foundation and pavement construction. In addition, it is recommended that WKA be retained to check compliance with design concepts and project specifications, and to provide consultation as required during construction.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by field exploration and laboratory testing programs. We performed our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed by members of our profession practicing in the Sacramento Valley area. If the proposed construction is modified, resited, or if it is found during construction that subsurface conditions differ from those we encountered at our test boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We recommend our firm be given the opportunity to review the final plans and specifications to determine if our recommendations have been implemented in those documents.

We emphasize that this report is applicable only to the proposed construction and the investigated site. This report should not be utilized for construction on any other site.

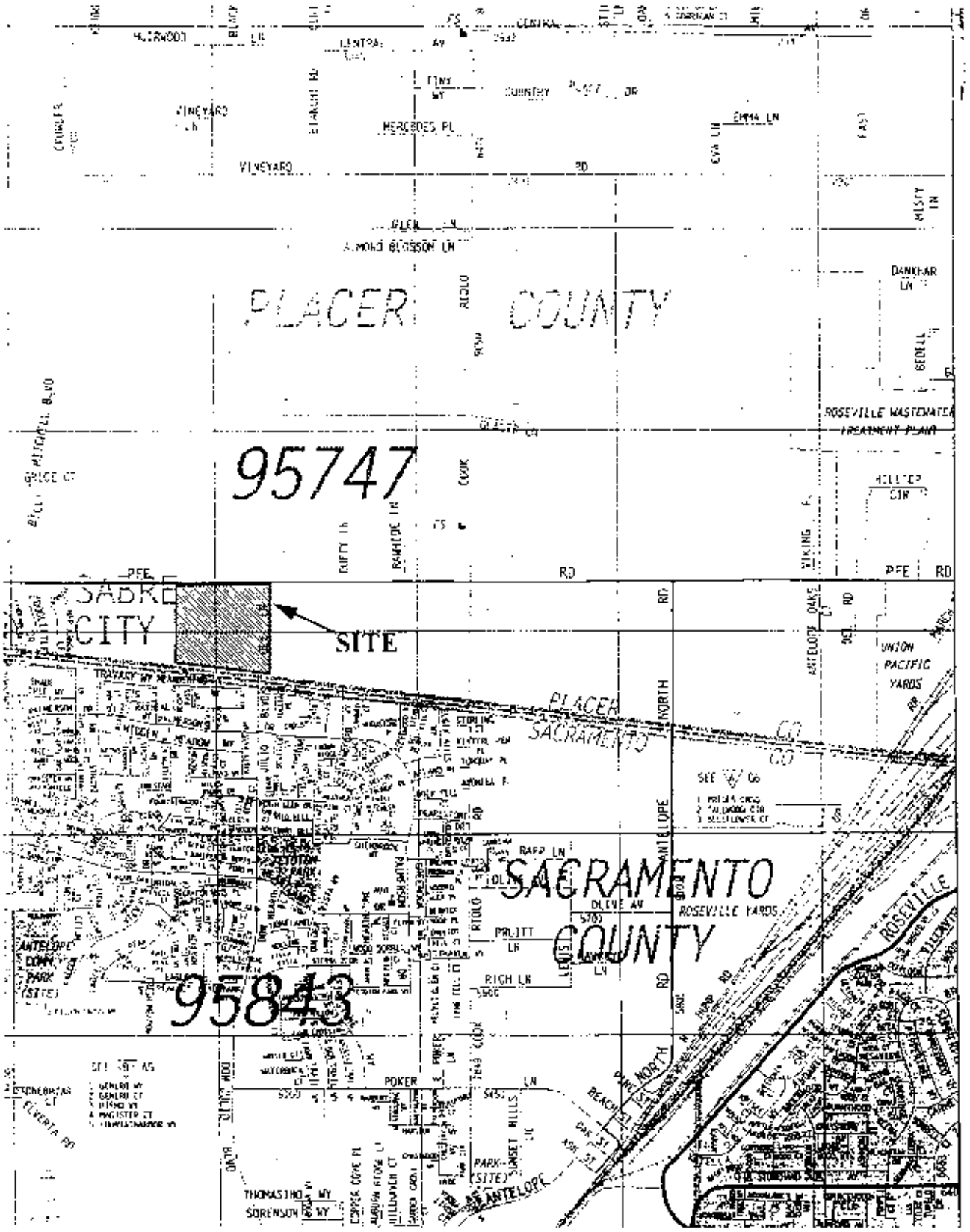
Wallace - Kuhl & Associates, Inc.

Troy W. Kamisky
Staff Engineer

Stephen L. French
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
STEPHEN L. FRENCH
No. 2223
Exp. 3-31-03
GEOTECHNICAL
STATE OF CALIFORNIA

TWK: SLF



Adapted from the Thomas Guide
Sacramento and Solano Counties
Street Guide and Directory, 2001 edition.

0 950 1900
Scale in Feet

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GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

PFE 36 ACRES

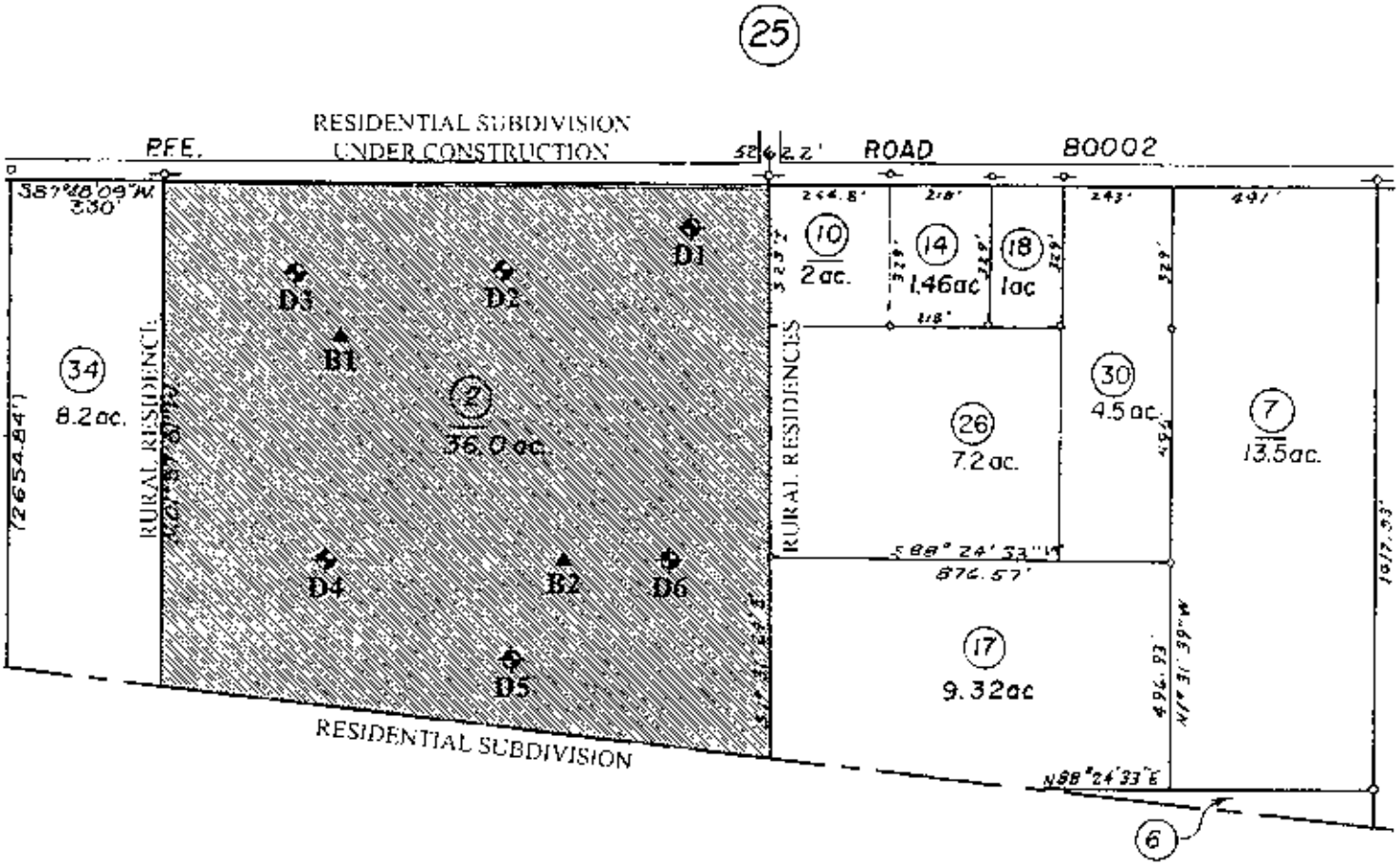
PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9'02

PLATE NO: 1



Adapted from the Sacramento County Assessor's Map Book 23, Page 26.

0 200 400
Scale in Feet

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PFE 36 ACRES

PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9/02

PLATE NO: 2

BORING NUMBER: D1
DATE DRILLED: 8/20/02
LOGGED BY: TWK

DRILL RIG/METHOD:
CME 55/6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							SC		Light brown, moist, stiff, clayey fine sand
		D1-1I	42				SM		Light brown, moist, dense, silty fine sand
5		D1-2I	22	94	23.8		ML		Light brown, moist, dense, fine sandy silt
10		D1-3I	41				SM		Light brown, moist, dense, silty fine to medium sand
15		D1-4I	50/6"				ML		Light brown, moist, hard, fine sandy, clayey silt
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration
2. Ground water was not encountered in the boring
3. For an explanation of the symbols used on the boring log, see Plate No. 9

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PFE 36 ACRES

PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9/02

PLATE NO: 3

BORING NUMBER: D2
DATE DRILLED: 8/20/02
LOGGED BY: TWK

DRILL RIG/METHOD:
CME 55/6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Light brown, slightly moist, stiff, clayey silt
		D2-11	35				SM		Light brown, moist, medium dense, silty fine sand
							ML		Light brown, moist, medium dense, fine sandy silt
5		D2-21	21	99	15.2		SM		Light brown, moist, medium dense, silty fine sand
									slightly clayey
10		D2-31	48						
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 3, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 9

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GEOLOGICAL & ENVIRONMENTAL SERVICES

PFE 36 ACRES

PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9/02

PLATE NO: 4

BORING NUMBER: B3
DATE DRILLED: 8/20/02
LOGGED BY: TWK

DRILL RIG/METHOD:
CME 55/8-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Light brown, slightly moist, stiff, fine sandy clayey silt
							SC		Brown, moist, very stiff, clayey sand
		B3-11	28	117	12.2				
5							ML		Light brown with reddish rust mottling, moist, hard, clayey silt
		B3-21	50/5"						
10									
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 9

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GEOLOGIC & ENVIRONMENTAL SERVICES

PFE 36 ACRES

PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9/02

PLATE NO: 5

BORING NUMBER: D4
DATE DRILLED: 8/20/02
LOGGED BY: TWK

DRILL RIG/METHOD:
CME 55/6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Light reddish brown, slightly moist, medium dense, fine sandy clayey silt
		D4-1I	71	93	22.6				
							ML		Light brown, moist, very stiff, fine sandy silt
5		D4-2I	41				SM		Light brown, moist, medium dense, silty fine sand
							ML		Light brown, moist, very stiff, fine sandy silt
10		D4-3I	50/5"						hard at 10 feet
							SM		Light brown, moist, medium dense, silty sand
15		D4-4I	35	97	4.1				
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used on the boring log, see Plate No. 9

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GEOLOGIC & ENVIRONMENTAL SERVICES

PFE 36 ACRES

PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9/02

PLATE NO: 6

BORING NUMBER: D5
DATE DRILLED: 8/20/02
LOGGED BY: TWK
DRILL RIG/METHOD: CME 55/6-INCH SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT	DRY UNIT WT (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Light brown, moist, medium dense, fine sandy silt
		D5-1I	15	112	18.8	6.9 (TSF) UCC	SC		Light reddish brown, moist, medium dense, clayey sand
5		D5-2I	35				ML		Grayish light brown, moist, very stiff, clayey silt
10		D5-3I	50/5"						hard at 11 feet
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 9

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PFE 36 ACRES

PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9/02

PLATE NO: 7

BORING NUMBER: D6
DATE DRILLED: 8/20/02
LOGGED BY: TWK
DRILL RIG/METHOD: CME 55/6-INCH SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Light brown, slightly moist, medium dense, fine sandy silt
		D6-1I	15	112	15.9		CL		Brown, moist, stiff, slightly sandy clay
							ML		Grayish light brown, moist, stiff, fine sandy silt
5		D6-2I	61				SM		Light brown, moist, dense, silty fine to medium sand
							ML		Light brown, moist, medium dense, fine sandy silt
10		D6-3I	40	112	8.4		SM		Light brown, moist, medium dense, silty sand
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 9

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PFE 36 ACRES

PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9/02

PLATE NO: 8

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - clay mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand - clay mixtures
FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL > 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler

= Drive Sample: no recovery

= Initial Water Level

= Final Water Level

= Estimated or gradational material change line

= Observed material change line

Laboratory Tests

PI = Plasticity Index
EI = Expansion Index
UCC = Unconfined Compression Test
TR = Triaxial Compression Test
GR = Gradational Analysis (Sieve)
K = Permeability Test

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

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GEOLOGIC & ENVIRONMENTAL SERVICES

PFE 36 ACRES

PFE Road

Placer County, California

WKA NO: 5232.02

DATE: 9/02

PLATE NO: 9

APPENDIX A

A. GENERAL INFORMATION

The performance of a geotechnical engineering investigation at the site of the proposed PFE 36 Acres residential subdivision located on PFE Road, west of Oly Lane in Placer County, California, was authorized by Mr. Jack Coulter on August 18, 2002. Authorization was for an investigation as described in our proposal letter dated August 8, 2002, sent to our client, County Builders, whose mailing address is 3050 Tilden Drive, Roseville, California 95661-7942; telephone (916) 782-1640; fax (916) 782-1810.

In performing this investigation, we made reference to a copy of a parcel map provided by County Builder.

B. FIELD EXPLORATION

Six test borings were drilled on August 20, 2002, utilizing a CME-55 truck-mounted drill rig at the approximate locations indicated on Plate No. 2. The borings were drilled to a maximum depth of approximately 15 feet below existing grade using six-inch diameter continuous flight helical augers. At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D., California sampler driven by a 140 pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch long sampler each 6-inch interval was recorded. The sum of the blows required to drive the sampler the lower 12-inch interval, or portion thereof, are designated the penetration resistance or "blow count" for that particular drive.

Immediately after recovery, the field engineer classified the soil and the ends of the tubes were sealed with plastic caps to preserve the natural moisture content. Bulk samples were collected of near-surface soils; the approximate locations of these samples are indicated on Plate No. 2. The samples were taken to our laboratory for additional soil classification and selection of samples for testing.

Selected bulk samples were collected of near-surface soils. Samples were taken to our laboratory for soil classification and additional testing.

C. LABORATORY TESTING

Selected undisturbed soil samples were tested to determine dry unit weight (ASTM D2937), natural moisture content (ASTM D2216) and unconfined compressive strength (ASTM D2166).

One representative bulk sample was subjected to Resistance value testing (CT 301) and Expansion Index (ASTM D4829). These test results are summarized on the attached Plates Nos. A1 and A2.

One near-surface soil sample was submitted to Sunland Analytical to determine the soil pH and minimum resistivity (CT 643), sulfate concentration (CT 417) and chloride concentration (CT 422). Results from these tests are included as Plate No. A3.

EXPANSION INDEX TEST RESULTS

UBC Standard No. 29-2

ASTM D4829-88

MATERIAL DESCRIPTION: Light brown, clayey fine, sandy silt

LOCATION: B2 (See plate No. 2)

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index *
0-2'	10.2	21.2	106	**46**

CLASSIFICATION OF EXPANSIVE SOIL **

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	**Low**
51 - 90	Medium
91 - 130	High
Above 130	Very High

* Corrected to 50% Saturation

** From UBC Table 29-C

RESISTANCE VALUE TEST RESULTS
(California Test 301)

MATERIAL DESCRIPTION: Light brown, clayey fine sandy silt

LOCATION: B2 (See Plate No. 2)

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (dial)	Expansion Pressure (psf)	R Value
1	118	14.1	438	42	182	22
2	117	15.0	350	33	143	17
3	114	15.8	271	21	91	11

R-Value at 300 psi exudation pressure = 13

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 09/04/2002
Date Submitted 08/29/2002

To: Todd Kamisky
Wallace-Kuhl & Associates,Inc.
3050 Industrial Blvd.
West Sacramento, Ca 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 5232.02-PFE 36 AC Site ID : B1.
Your purchase order number is 6205.
Thank you for your business.

* For future reference to this analysis please use SUN # 37952-72998.

EVALUATION FOR SOIL CORROSION

Soil pH	6.15		
Minimum Resistivity	2.20	ohm-cm (x1000)	
Chloride	13.2 ppm	00.00132	%
Sulfate	5.0 ppm	00.00050	%

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX B

EARTHWORK SPECIFICATIONS

PFE 36 ACRES

PFE Road

Placer County, California

WKA No. 5232.02

PART 1: GENERAL

1.1 SCOPE

a. General Description

This item shall include all clearing of trees, brush and associated items; preparation of surfaces to be filled, filling, spreading, compaction, observation and testing of the fill; and all subsidiary work necessary to complete the grading of the building areas to conform with the lines, grades and slopes as shown on the accepted Drawings.

b. Geotechnical Engineer

Where specific reference is made to "Geotechnical Engineer" this designation shall be understood to include both the firm and the individual representatives of that firm.

1.2 PROTECTION

a. Adequate protection measures shall be provided to protect workmen and passers-by the site. Adjacent property shall be fully protected throughout the operations.

b. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

c. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.

d. Surface drainage provisions shall be made during the period of construction in a manner to avoid creating a nuisance to adjacent areas.

e. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

1.3 GEOTECHNICAL REPORT

a. A Geotechnical Engineering Report (WKA No. 5232.02, dated September 17, 2002) has been prepared for this site by Wallace - Kuhl & Associates, Inc., Geotechnical Engineers of West Sacramento, California [(916) 372-1434]. A copy is available for review at the office of Wallace - Kuhl & Associates, Inc.

b. The information contained in this report was obtained for design purposes only. The contractor is responsible for any conclusions he may draw from this report; should he prefer not to assume such risk, he should employ his own experts to analyze available information and/or to make additional borings upon which to base his conclusions, all at no cost to the Owner.

1.4 EXISTING SITE CONDITIONS

The Contractor shall acquaint himself with all site conditions. If unshown active utilities are encountered during the work, the owner shall be promptly notified for instructions. Failure to notify will make the Contractor liable for damage to these utilities arising from Contractor's operations subsequent to his discovery of such unshown utilities.

1.5 SEASONAL LIMITS

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate that the moisture contents of the subgrade and fill materials are satisfactory.

PART 2: PRODUCTS

2.1 MATERIALS

a. All fill shall be of approved local materials from required excavations, supplemented by imported fill, if necessary. Approved local materials are defined as local granular soil free from significant quantities of rubble, rubbish and vegetation, and having been tested and approved by the Geotechnical Engineer prior to use. Clods, rocks or hard lumps exceeding four inches (4") in final size shall not be allowed in the upper two feet (2') of any fill placed in structural areas.

b. Imported fill materials shall be approved by the Geotechnical Engineer; they shall meet the above requirements; shall have plasticity indices not exceeding fifteen (15), and an expansion indices not exceeding twenty (20); and, shall be of four-inch (4") maximum particle size.

c. Asphalt concrete, aggregate base, aggregate subbase, and other paving products shall comply with the appropriate provisions of the State of California (Caltrans) Standard Specifications, dated July 1992.

PART 3: EXECUTION

3.1 LAYOUT AND PREPARATION

Lay out all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection of utilities--all prior to beginning actual earthwork operations.

3.2 CLEARING, GRUBBING AND PREPARING BUILDING PAD, AND PAVEMENT AREAS

a. All vegetation to be removed, and loose and/or saturated materials shall be removed and disposed of so as to leave the areas that have been disturbed with a neat and finished appearance, free from unsightly debris. Excavations and depressions resulting from the removal of such items, as well as any existing excavations or loose soil deposits, as determined by the Geotechnical Engineer,

shall be cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications.

b. The surfaces upon which fill is to be placed shall be plowed or scarified to a minimum depth of at least twelve inches (12"), additional scarification may be required to remove any observed roots. Subgrade preparation shall continue until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the selected equipment.

c. When the moisture content of the subgrade is below that required to achieve the specified density, water shall be added until the proper moisture content is achieved.

d. When the moisture content of the subgrade is too high to permit the specified compaction to be achieved, the subgrade shall be aerated by blading or other methods until the moisture content is satisfactory for compaction.

e. After the foundations for fill have been cleared, plowed, or scarified, they shall be disced or bladed until uniform and free from large clods, brought to the proper moisture content and compacted to not less than ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Compaction Test.

3.3 PLACING, SPREADING AND COMPACTING FILL MATERIAL

a. The selected fill material shall be placed in layers which when compacted shall not exceed six inches (6") in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to promote uniformity of material in each layer.

b. When the moisture content of the fill material is below that required to achieve the specified density, water shall be added until the proper moisture content is achieved.

c. When the moisture content of the fill material is too high to permit the specified degree of compaction to be achieved, the fill material shall be aerated by blading or other methods until the moisture content is satisfactory.

d. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to at least ninety percent (90%) as determined by the ASTM D1557 Compaction Test. Compaction shall be undertaken with equipment capable of achieving the specified density and shall be accomplished while the fill material is at the required moisture content. Each layer shall be compacted over its entire area until the desired density has been obtained.

e. The filling operations shall be continued until the fills have been brought to the finished slopes and grades as shown on the accepted Drawings.

3.4 TESTING AND OBSERVATION

a. Grading operations shall be observed by the Geotechnical Engineer, serving as the representative of the Owner.

b. Field density tests shall be made by the Geotechnical Engineer after compaction of each layer of fill. Additional layers of fill shall not be spread until the field density tests indicate that the minimum specified density has been obtained.

c. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

d. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer and the Engineer. No deviation from the specifications shall be made except upon written approval of the Geotechnical Engineer or Engineer.

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GEOTECHNICAL ENGINEERING REPORT

ALMOND RANCH RESIDENTIAL SUBDIVISION

WKA No. 5373.04

July 8, 2003

WALLACE • KUHL & ASSOCIATES INC.

WALLACE - KUHL
& ASSOCIATES INC.

Geotechnical Engineering Report

ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA No. 5373.04

July 8, 2003

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed Almond Ranch residential subdivision located east of Oly Lane, south of PFE Road in Placer County, California. The purposes of our work have been to explore the site, soil and ground water conditions across the property, and to provide geotechnical engineering conclusions and recommendations regarding residential development of the property.

Scope

Our scope of work has included the following tasks:

1. site reconnaissance;
2. review of historic USGS topographic maps and historical aerial photographs of the property;
3. subsurface investigation, including the drilling of five test borings to a maximum depth of approximately 16½ feet below the ground surface, bulk sampling of anticipated pavement subgrade soils;
4. laboratory testing of selected soil samples;
5. engineering analyses; and,
6. preparation of this report.

Our office has prepared an *Environmental Site Assessment* of the subject property (WKA No. 5373.03, dated June 6, 2003) and several geotechnical engineering investigations in the surrounding area. Site and soil-related information contained in those reports was used to assist us in the preparation of this report.

Our office also is presently preparing a *Geotechnical Engineering Report* (WKA No. 5573.05) for the planned Almond Ranch trunk sewer alignment. That report will be provided under a separate cover.

Plates and Attachments

This report contains a Site Vicinity Map, Plate No. 1; a Boring Location Plan, Plate No. 2; and, Logs of Borings, Plates No. 3 through 7. An explanation of the symbols and classification system used on the logs is included as Plate No. 8. Appendix A contains general information regarding project concepts, exploratory methods used during our field investigation, and laboratory test results not shown on the logs. Appendix B contains *Earthwork Specifications* that may be used in the preparation of contract documents.

Proposed Development

Based on our conversations with representatives of Town Development of Sacramento, we understand the approximate nine-acre property will be developed with a residential subdivision consisting of one- and two-story, wood-frame houses with interior slab-on-grade lower floors. Building loads typical of ordinary residential construction are assumed for the houses. Associated development will include construction of interior roadways, underground utilities, exterior flatwork, landscape corridors and sound walls.

Grading plans are not available, however, based on existing site topography we anticipate maximum excavations and fills on the order of six to eight feet for residential development the site.

FINDINGS

Site Conditions

The subject property consists of gently to moderately rolling open grassland, located adjacent to the north of the Sacramento/Placer County line in Placer County, California. The property is

bounded to the north by rural residences; to the east by an open field and rural residence; to the south by a residential subdivision; and, to the west by an open field. Our review of historic aerial photographs and topographical maps indicates the property has been historically used for agricultural purposes since the early 1960's. Review of the *USGS 7.5-Minute Topographic Map of the Citrus Heights Quadrangle, California (1992),* indicates site elevations ranging from approximately +125 feet relative to mean sea level (msl) near the southwest corner of the property to +140 feet msl near the eastern portion of the property.

At the time of our field exploration on June 3, 2003, the subject property supports a rural residence, two horse and livestock shelters, irrigated pasture and natural grass grazing land for horses. The rural residence and one live stock shelter are located near the southwest corner of the site. The northwest portion of the site is supports the irrigated pasture, an equestrian area and a horse shelter. The remainder of the site was vacant and covered with a moderate to dense growth of voluntary grasses and weeds. A drainage swale (approximately 10 feet wide and 5 feet deep) was observed in the southwest portion of the property and appeared to be formed naturally from the runoff from the adjacent properties. The drainage swale generally drains in a south to northwesterly direction. The swale contained cattails, reeds, brush, trees and tall grasses, and was observed to have minor amounts of clear running water. Mature trees and shrubs were observed at various locations across the site with higher concentrations near the existing residence.

Soil Conditions

Results of the test borings revealed the upper 3½ to nine feet consisting of brown and light grayish brown, silty clays and clayey silts underlain by interbedded layers of variably cemented fine sands and silts to the maximum depth explored of 16½ feet below existing site grades.

Please refer to the Logs of Borings, Plates No. 3 through 7, for more detail regarding subsurface soil conditions at a particular location.

Ground Water

Free ground water was not encountered within test borings drilled performed on June 3, 2003. Review of the Sacramento County ground water map (published Spring 2000) indicates that the ground water beneath the subject property is located at an elevation of approximately -20 feet msl, or roughly 145 feet below the lowest existing site grades.

CONCLUSIONS

Seismic Code Design

The entire State of California is considered to be subject to ground shaking from numerous active fault systems across the state. Based on tables provided in the 1997 edition of the *Uniform Building Code* (UBC), the proposed development has the following site characteristics. The site is located within Seismic Zone 3. The site soil conditions most closely approximate an S_D profile. The site is not located within 15 kilometers of an active or potentially active fault; therefore, near-fault effects will not be a factor in seismic design, nor is a seismic source type assigned using the 1997 UBC.

Building Support

Field and laboratory test results indicate the undisturbed native soils are capable of supporting the proposed residential structures. We anticipate that the near-surface soils in the vicinity of the existing rural residence and equestrian areas will become severely disturbed during site demolition. Therefore, it is emphasized that thorough recompaction of the upper soils in these areas will be important to providing uniform support for the planned structures and pavements. Our work also indicates that engineered fill, properly placed and compacted in accordance with the recommendations of this report, will be capable of supporting the planned residential structures and pavements.

Excavation Conditions

The test borings were drilled with a CME-55 truck mounted drill rig, which encountered little difficulty penetrating the on-site soils. Based upon this and our local experience, conventional grading and trenching equipment will be able to perform the excavations required at the site within the depths explored.

Excavations less than five feet in depth likely will stand at a near-vertical inclination for short periods of time, unless zones or pockets of clean cohesionless sands are encountered or the construction is performed during the rainy season. Excavations encountering perched water or saturated soils may slough or cave if left open for an extended period of time. Excavations that exceed five feet in depth and will be entered by workers must conform to current Cal/OSHA requirements (i.e., sloped, braced, or shored). Temporarily sloped excavations should be constructed no steeper than one horizontal to one vertical (1:1).

Expansive Soils

Laboratory test results indicate the surface and near-surface silts and clays posses a moderate expansion potential when tested in accordance with ASTM D4829 (see Plate No. A1). Based on laboratory testing and our experience, these soils are capable of developing moderate swelling pressures on foundations and slab system due to varying soil moisture contents. Recommendations to mitigate the effects of expansive soils are presented later in this report.

Pavement Subgrade Quality

Laboratory test results indicate the on-site silty clays are moderately good quality materials (Resistance value of 19) for the support of asphalt concrete pavements (see Plate No. A2). Based on our laboratory data and experience in the area, we have selected an R-value of 15 for design of pavements to account for probable variations in the soils that may be exposed at final subgrade elevation.

Fill Material Suitability

The on-site soils encountered in our borings are considered suitable for use as engineered fill materials if they are free of debris and organic concentrations, and are at suitable moisture content. Special recommendations are contained in this report regarding the use of expansive clays in engineered fill.

Soil Corrosion Potential

A sample of the near-surface soil was submitted to Sunland Analytical Labs for testing to determine pH, resistivity, sulfate and chloride concentrations to help evaluate the potential for corrosive attack upon buried metal structures and reinforced concrete. The test results for the sample revealed a minimum resistivity of 1150 ohm-centimeters (Ω-cm) with a soil pH of approximately 6.30. Sulfates were recorded at 43.1 parts per million (ppm) and chlorides at 100.9 ppm. Results of this testing are summarized on Plate No. A3.

Published literature[1] suggests that a "corrosive area" is an area where the soil and/or water contains more than 500 parts per million (ppm) of chlorides, more than 200 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-centimeters or has a pH of less than 5.5. Table 19-A-4 of the 1997 UBC, *Requirements for Concrete Exposed to Sulfate-Containing Solutions*, indicates the sulfate exposure for the samples tested are *Negligible*. Based on this criterion we did not encounter a corrosive area within the site for the samples tested. Ordinary Type I-II Portland cement is indicated to be suitable for use on this project, assuming a minimum cover is maintained over the reinforcement.

Wallace-Kuhl & Associates are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site, or to determine the need or design parameters for cathodic protection or grounding systems, a corrosion engineer should be consulted.

---

[1] California Department of Transportation Corrosion Technology Section, Office of Materials and Foundations, *Interim Corrosion Guidelines For Foundation Investigations*, May 1999.

Ground Water/Seasonal Moisture

In our opinion, a permanent ground water table should not be a significant factor in design or construction of the proposed subdivision. However, during the winter and spring months, infiltrating surface run-off water will create saturated surface soil conditions due to the impervious nature of the underlying cemented soils. It is probable that grading operations attempted following the onset of winter rains and prior to prolonged drying periods will be hampered by high soil moisture contents. Such soils, intended for use as engineered fill, will require a prolonged period of dry weather and/or considerable aeration to reach a moisture content suitable for proper compaction. This should be considered in the construction schedule.

Erosion and Winterization

The on-site soils generally consist of silts and clays. In our opinion, the undisturbed soils and fill materials consisting of on-site soils may be susceptible to erosion by surface run-off that occurs during intense rainfall. As a minimum, erosion control measures including placement of straw bale sediment barriers or construction of silt filter fences in areas where surface run-off may be concentrated would be prudent. The project civil engineer should develop a site-specific erosion and sediment control plan based upon their site grading and drainage plan, and the anticipated construction schedule. The erosion and winterization measures contained in the publication *Erosion and Sediment Control Guidelines for Developing Areas of the Sierra Foothills and Mountains*, dated October 1991, would be appropriate for developing such a plan.

RECOMMENDATIONS

General

Grading plans for the project have not yet been developed; therefore, for the purposes of preparing this report we have assumed maximum excavations and fills of around six to eight feet to develop the site. The recommendations in this report are based on this assumption.

Also, the recommendations presented below are appropriate for typical construction in the late spring through fall months. The on-site soils likely will be saturated by rainfall in the winter and early spring months, and will not be compacted without drying be aeration or the addition of lime (or a similar product) to dry the soils. Should the construction schedule require work to continue during the wet months, additional recommendations can be provided, as conditions warrant.

We should review the final grading plans to verify that the recommendations of our report remain applicable.

Site Clearing

Initially, the site should be cleared of all surface and subsurface structures associated with current development of the site, including all foundations, concrete and asphalt pavements, utility poles, septic leach fields, burn pits and any underground utilities designated to be removed or relocated, including all trench backfill. Existing domestic wells on-site should be properly abandoned in accordance with Placer County Environmental Health Department requirements. Trees and shrubs designated to be removed should include the entire rootball and all roots larger than ½-inch in diameter. Excavations or depressions resulting from the removal of these items should be restored to grade with engineered fill placed and compacted in accordance with the recommendations contained in this report.

Existing drainage areas should be cleaned of organics, and saturated or unstable soils to expose firm, native materials as determined by our representative. The excavated soils from the drainage channel are anticipated to contain moderate concentrations of organics; therefore, we recommend that the materials be disposed of off-site and not reused as fill materials. The exposed surface should be scarified to a depth of at least eight inches, moisture conditioned to at least the optimum moisture content (as necessary) and recompacted to at least 90 percent of the ASTM D1557 maximum dry density. Our representative can provide alternative recommendations for stabilizing the bottom of excavations, as conditions warrant.

Remaining surface vegetation should be removed by stripping. Strippings should be removed from the site or used as fill only in backyard areas. Strippings used in backyards should be kept at least five feet horizontally from the building pads. Strippings should not be used in landscape

areas berms that will support sound walls. Strippings should be moisture conditioned, not exceed a vertical thickness of two feet, and receive reasonable compactive effort.

Discing may be a suitable alternate to stripping, depending upon the quantity and condition of the organics at the time of grading. Discing should only be allowed with our approval after review of the site conditions at the time of grading.

Site Preparation and Engineered Fill Construction

Following clearing activities, the exposed soils in areas to receive fill and at-grade areas should be scarified to a depth of at least 12 inches, moisture conditioned to at least two percent above the optimum moisture content and compacted to at least 90 percent of the maximum dry density per ASTM D1557. Deeper scarification may be required, depending upon the depth of soil disturbance observed by our representative. Our representative will determine the need for the deeper scarification.

In areas that presently and previously supported structures, the existing grades should be thoroughly ripped and cross-ripped to a depth of 12 inches to help uncover and remove structure remnants, debris and rubble. Adequate removal of debris and tree roots may require handpicking by laborers to clear the subgrade soils to the satisfaction of our on-site representative, prior to further site preparation. The processed soil should then be thoroughly moisture conditioned to at least the optimum moisture content and uniformly compacted to at least 90 percent of the ASTM 1557 maximum dry density.

If construction begins during the summer or fall, there a potential that the surface clay soils may be desiccated deeper than the recommended depth of scarification. Should this condition exist, the site should be continuously watered for a sufficient period of time to close the desiccation cracks to within 12 inches of the surface. Prewatering of the site should not be necessary if grading operations begin in the early spring months prior to the soils having a chance to dry significantly

Compaction activities must be performed in the presence of our representative who will evaluate the performance of the subgrade under compactive load and identify any loose or unstable soil

conditions that could require additional excavation. Compaction operations should be accomplished with a heavy, self-propelled, sheepsfoot compactor (Caterpillar 815 or equivalent).

Difficulty in achieving subgrade compaction or unusual soil instability may be indications of loose fill associated with past subsurface items such as septic tanks, cisterns, dump pits or utility lines. Should these conditions exist, the materials should be excavated to check for subsurface structures and the excavations backfilled with engineered fill. We recommend construction bid documents contain a unit price (price per cubic yard) for all excess excavation due to unsuitable materials and replacement with engineered fill.

Engineered fill to be placed on existing slopes that are steeper than six horizontal to one vertical (6:1) should begin with a level bench constructed at the toe of the fill. The bench should consist of a level terrace excavated horizontally four feet into the hillside. Benching should be done progressively up the hillside at vertical increments not exceeding two feet. On slopes steeper than four horizontal to one vertical (4:1), a key should be constructed at the toe of the fill. The toe key should be at least 15 feet wide, centered along the toe of the fill slope, and excavated to a depth of at least two feet (measured from the down-slope side) into dense materials. Benching and toe key construction must be observed and approved by our representative.

To reduce the potential for differential settlement of building foundations, the building pads constructed partially by cut and partially by fill that exceed five feet in thickness, and individual lots with fill differentials that exceed five feet should be avoided. Building pads with either of these conditions should be over-excavated so that the fill differential across the building pad does not exceed five feet. We should review the grading plans and work with the contractor to determine the areas, if any, requiring over-excavation.

On-site soils are considered suitable for use in engineered fill construction, if free of significant concentrations of organic material, rubble or debris. Imported fill materials should be granular materials with non-plastic fines (Plasticity Index of 15 or less, Expansion Index of 20 or less and R-value of at least 15), be free of particles greater than four inches in largest dimension. Imported soils must be approved by our office prior to being transported to the project site. Clay soils, exposed during site excavations may be used in deeper fills at the site, but should be excluded from the upper foot of building pad fills, when possible.

Engineered fill should be placed in lifts not exceeding six inches in compacted thickness, with each lift being uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 90 percent relative compaction. Clay soils used in fill construction should be moisture conditioned to at least two percent above the optimum moisture content.

The upper six inches of soil subgrade in pavement areas should be uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 95 percent relative compaction.

Lots achieved by excavation should be observed by our representative to determine if clay soils are present. Expansive clay soils exposed at or within 12 inches of final building pad elevation should be removed and replaced with on-site granular soils placed and compacted as engineered fill. The bid documents should include a per yard unit price for additional excavation and replacement with engineered fill. If the clay soils are not removed from building pad subgrades, or if clays are used for fill within the upper foot of the building pads, such building pads will be designated as expansive and will require special foundation and slab construction recommendations.

Site preparation should be accomplished in accordance with the recommendations of this section and the appended *Earthwork Specifications* contained in Appendix B. *It is essential that our representative be regularly present during the excavation, scarification and compaction operations to evaluate the proper compaction of the materials. Our representative also should be present throughout grading operations to observe and test the fill materials, as necessary.*

Trench Backfill

All utility trench backfill should be mechanically compacted in maximum 12-inch thick lifts to at least 90 percent of maximum dry density. We recommend that only native soils be used as trench backfill within the perimeter of the building foundations to help minimize soil moisture variations beneath the structure. The native soil backfill should extend at least three feet beyond perimeter foundation lines. **Jetting is not recommended for compaction of utility trench backfill.**

Utility trench backfill and compaction, and pipe bedding and initial backfill of utility lines within County right-of-ways should conform with Placer County Standards and the pipe manufacturers recommendations.

Foundation Design

One- and two-story residential structures may be supported upon continuous and isolated spread foundations that extend at least 12 inches into the compacted building pad, as measured from lowest adjacent soil grade. For this project, the building pad subgrade is defined as the soil surface on which capillary break gravel is placed. A continuous, reinforced foundation should be utilized for the perimeter of the structures to act as a "cut-off" to help minimize moisture infiltration and variations beneath the slab-on-grade areas of the structures. Continuous foundations should be at least 12 inches wide; isolated spread foundations should maintain a minimum 18-inch dimension.

Foundations bearing in undisturbed or recompacted native soils, engineered fill, or a combination of these materials may be sized for vertical loads utilizing maximum allowable soil bearing pressures of 1500 per square foot (psf) for dead load, 2250 psf for dead plus live load or 3000 psf for total load, including the effects of seismic or wind forces. The weight of foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations.

We recommend that all foundations be adequately reinforced to provide structural continuity, mitigate cracking and permit spanning of local soil irregularities. The structural engineer should determine the foundation reinforcing requirements. However, *as a minimum,* we recommend that continuous foundations be reinforced with at least two No. 4 steel reinforcing bars, placed one each, near the top and bottom of the foundations.

Resistance to lateral displacement of shallow foundations may be computed using an allowable friction factor of 0.30 multiplied by the effective vertical load on each foundation. Additional lateral resistance may be achieved using an allowable passive earth pressure against the vertical projection of the foundation equal to an equivalent fluid pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the frictional component is reduced by

50 percent since mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

Interior Floor Slab Support

Non-Expansive Building Pads

Concrete slabs-on-grade may be suitably supported upon soil subgrades prepared in accordance with the recommendations in this report. Interior concrete slab-on-grade floors should be at least four inches thick; the structural engineer should determine final slab thickness and reinforcing based upon the anticipated floor loads. From a crack-control standpoint, a light gauge 6x6/W1.4xW1.4 welded wire fabric (in rolls) would be suitable for slab reinforcement; however, it has been our experience that it is more difficult to consistently locate the lighter gauge wire mesh at mid-slab depth. Accurate and consistent location of the reinforcement at mid-slab is essential to its performance and the risk of uncontrolled drying shrinkage slab cracking is increased if the reinforcement is not properly located within the slab. Therefore, we recommend consideration should be given to using a heavier gauge 6x6/W2.9xW2.9 wire (flat sheets) placed on chairs, or No. 3 rebar at 24-inches each way in the slab.

Interior floor slabs may be underlain by a layer of free-draining gravel, serving as a deterrent to migration of capillary moisture. The gravel layer should be at least four inches thick, and should be graded such that 100 percent passes a one-inch sieve and none passes a No. 4 sieve. Additional moisture protection may be provided by placing a sheet plastic membrane (10-mil or thicker) directly over the gravel. The plastic membrane should meet or exceed the minimum requirements for plastic water vapor retarders as outlined in ASTM E-1745. An optional, thin layer of clean sand above the membrane is acceptable, as an aid to curing of the slab concrete.

Expansive Building Pads

Slabs constructed on expansive soils should contain *at least* 6x6/W2.9xW2.9 welded wire mesh reinforcement or No. 3 rebar located on maximum 18-inch centers each way throughout the slab, to help minimize the effects of expansive clays. Location of the reinforcement at mid-slab is essential to its performance. Floor slabs constructed on expansive soils must have the upper 12 inches of the soil subgrade brought to a near-saturated condition prior to concrete slab placement.

Adequate moisture conditioning must be verified by our office within 48 hours prior to slab placement. Use of the vapor barrier membrane is considered essential when presaturation is accomplished.

Floor Slab Moisture Penetration Resistance

It is considered likely that floor slab subgrade soils will become wet to near-saturated at some time during the life of the structures. This is a certainty when slabs are constructed during the wet seasons, when the pads are moisture conditioned prior to slab construction, or when constantly wet ground or poor drainage conditions exist adjacent to structures. For this reason, it should be assumed that all slabs in living areas, as well as those intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. Standard practice includes the gravel, plastic membrane and sand as suggested above. However, the gravel and plastic membrane offer only a limited, first line of defense against soil-related moisture. Recommendations contained in this report concerning foundation and floor slab design are presented as *minimum* requirements, only from the geotechnical engineering standpoint.

It is emphasized that we are not slab moisture-proofing or moisture protection experts. We are expressly stating that we make no guarantee nor provide any assurance that use of the sub-slab gravel and sheet plastic will reduce slab moisture penetration to any specific amount or level, particularly those required by floor covering manufacturers. The builder and designers should consider all available measures for slab moisture protection. If increased protection against vapor penetration of slabs is desired, a concrete moisture protection specialist should be consulted. It is commonly accepted that maintaining the lowest practical water-cement ratio in the slab is one of the most effective ways to reduce future moisture vapor penetration of the completed slab.

The recommendations presented above are provided to help minimize soil-related cracking of slab-on-grade floors. Equally important to the performance and appearance of Portland cement concrete slabs is the quality of the concrete, the skill of the concrete contractor, curing techniques utilized and the spacing of control joints.

Exterior Concrete Flatwork

Areas to receive exterior flatwork (sidewalks, patios, etc.) should be thoroughly moisture conditioned and properly compacted prior to placement of concrete. Uniform moisture conditioning of subgrade soils is important to reduce the risk of non-uniform moisture withdrawal from the concrete and the possibility of plastic shrinkage cracks. Practices recommended by the Portland Cement Association for proper placement and curing of concrete should be followed during exterior concrete flatwork construction. Flatwork should be independent of the building foundations and felt strips should be used to separate concrete slabs from adjacent existing concrete structures.

Site Drainage

Final site grading should be accomplished to provide positive drainage of surface water away from the buildings and prevent ponding of water adjacent to foundations. The grade adjacent to the structures should be sloped away from the foundations at a minimum two percent slope for a distance of at least five feet, where possible. Roof gutter downspouts and surface drains should be connected to solid PVC piping and directed towards appropriate drainage facilities, or the downspouts should drain onto concrete surfaces sloping away from the structures.

Pavement Design

Based on Resistance ("R") value testing, our experience in the area, and using a range of design traffic indices, we have calculated pavement section alternatives for a Resistance-value of 15. The procedures used for designing the pavement section are in general conformance with the "Flexible Pavement Structural Design Guide for California Cities and Counties" and applicable portions of the Caltrans Highway Design Manual. The project civil engineer should select the appropriate pavement sections based upon Placer County requirements.

PAVEMENT DESIGN ALTERNATIVES R-value = 15		
Traffic Index (TI)	Type B Asphalt Concrete (inches)	Aggregate Base (inches)
5.0	2½	7
	3*	6
5.5	2½	8
	3*	7
6.0	3	9
	3½*	8
6.5	3	10
	3½*	9

* includes the Caltrans factor of safety applied to the asphalt concrete thickness

We emphasize that pavement performance is critically dependent upon adequate and uniform compaction of the subgrade soils, as well as all engineered fill and utility trench backfill within the limits of the pavements. The upper six inches of pavement soil subgrade should be compacted to at least 95 percent relative compaction at a moisture content of at least the optimum moisture. Aggregate base should be compacted to at least 95 percent maximum dry density.

Materials quality and construction within the structural sections should comply with Placer County Standards and applicable provisions of the Caltrans Standard Specifications.

Construction Testing and Observation

Geotechnical testing and observation services during construction is considered a continuation of our geotechnical engineering investigation. Wallace - Kuhl & Associates, Inc. should be retained to provide testing and observation services during site grading, and foundation and pavement construction. In addition, it is recommended that WKA be retained to check compliance with

design concepts and project specifications, and to provide consultation as required during construction.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by field exploration and laboratory testing programs. We performed our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed by members of our profession practicing in the Sacramento Valley area. If the proposed construction is modified, resited, or if it is found during construction that subsurface conditions differ from those we encountered at our test boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We recommend our firm be given the opportunity to review the final plans and specifications to determine if our recommendations have been implemented in those documents.

We emphasize that this report is applicable only to the proposed construction and the investigated site. This report should not be utilized for construction on any other site. This report is considered valid for the proposed construction for a period of two years following of this report. If construction has not started within two years, we must re-evaluate the recommendations of this report and update the report, if necessary.

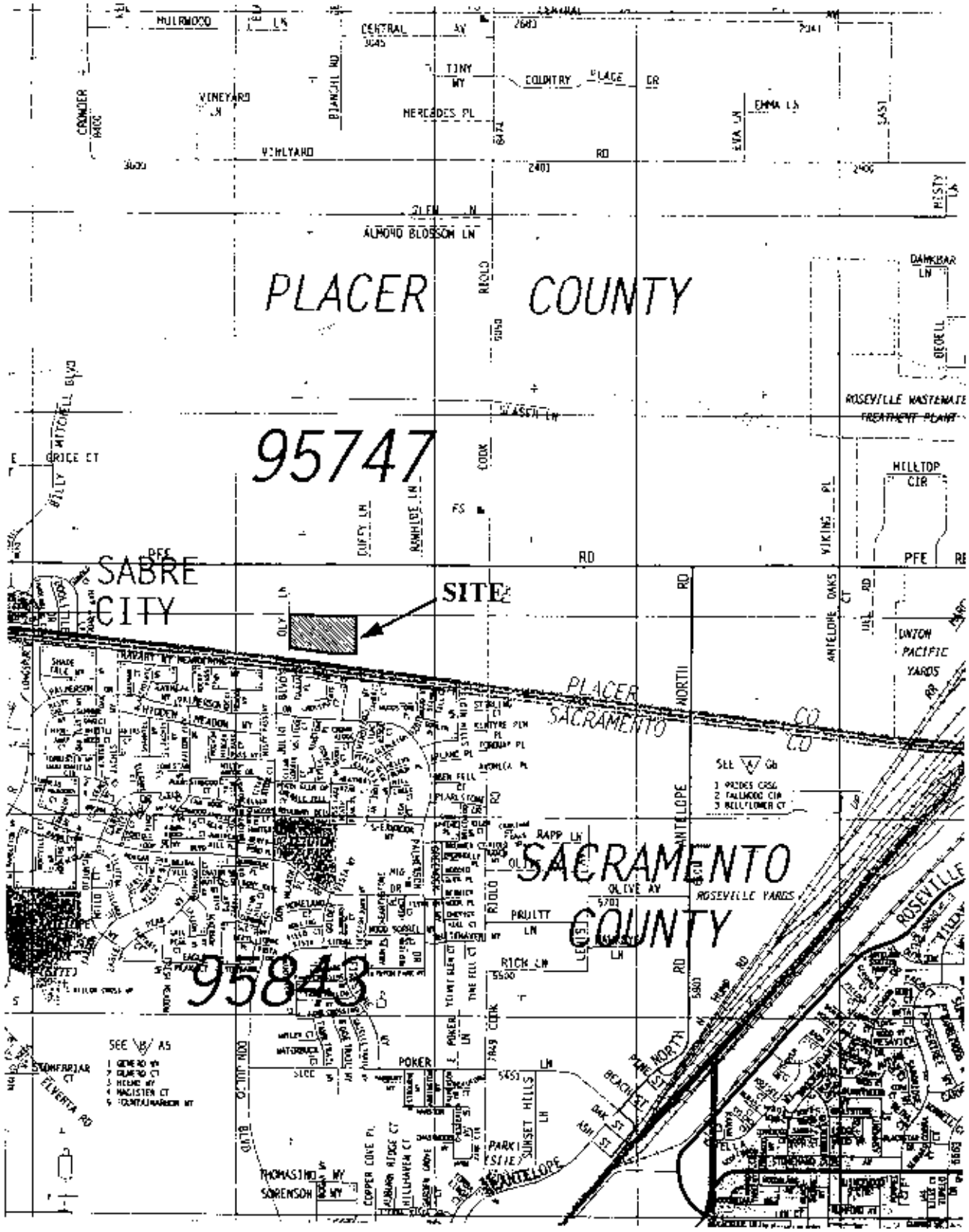
Wallace - Kuhl & Associates, Inc.

Troy W. Kamisky
Staff Engineer
TWK:MMW

Michael M. Watari
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
MICHAEL M. WATARI
No. 57722
Exp. 12/31/05
CIVIL
STATE OF CALIFORNIA

7/9/03



Adapted from the Thomas Guide
Sacramento and Solano Counties
Street Guide and Directory, 2001 edition.

WALLACE - KUHL & ASSOCIATES, INC.
GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

ALMOND RANCH RESIDENTIAL SUBDIVISION

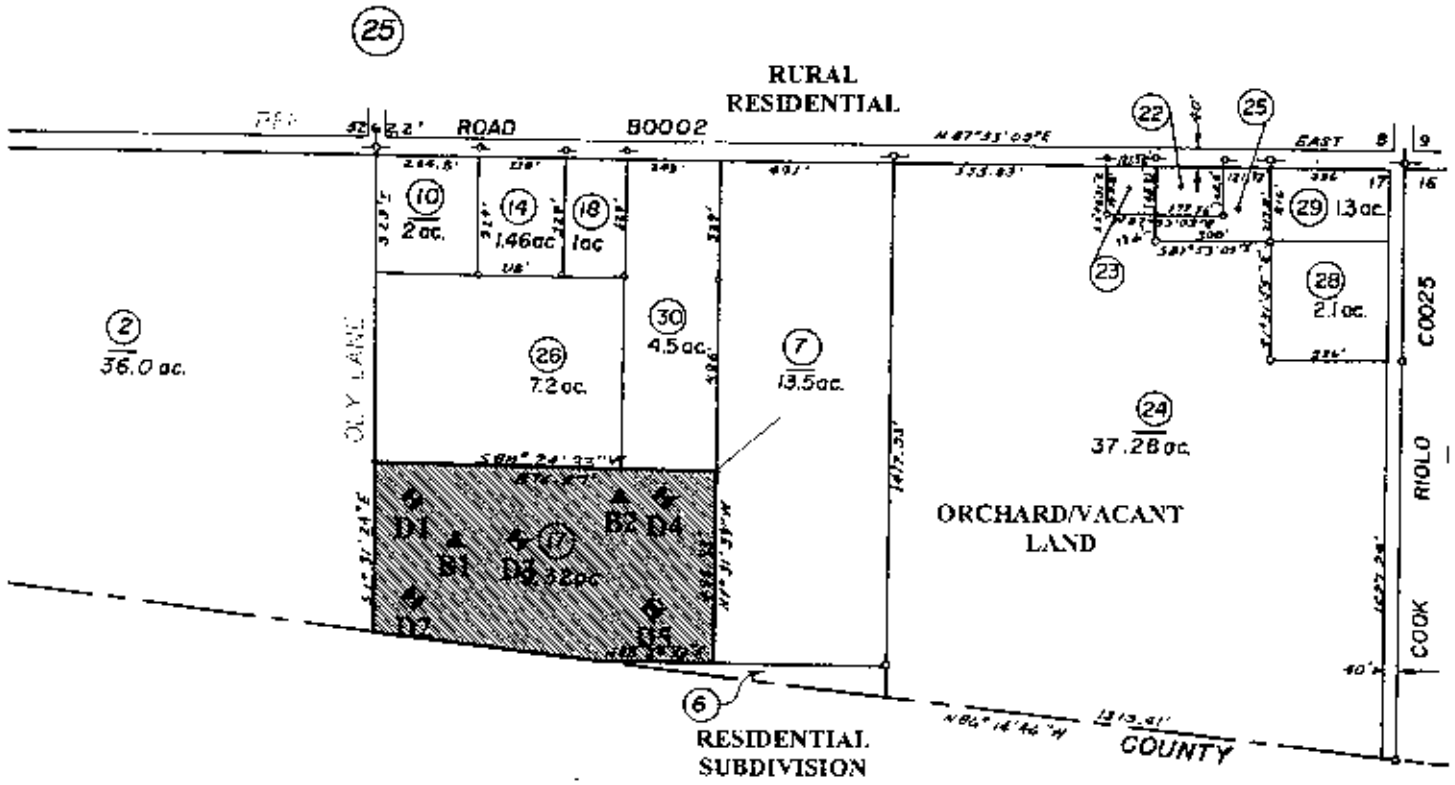
Oly Lane

Placer County, California

WKA NO: 5373.04

DATE: 7/03

PLATE NO: 1



Legend:

◆ -Approximate soil boring location

▲ -Approximate bulk sample location

Note:

Adapted from the Placer County Assessor's Map Book 23, Page 26.

0 250 500

Scale in Feet

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ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA NO: 5373.04

DATE: 7/03

PLATE NO: 2

BORING NUMBER: D1
DATE DRILLED: 6/3/03
LOGGED BY: EW

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							CL		Brown, fine sandy, silty clay
		D1-1I	39						
		D1-2I	50/6"				SM		Brown, variably cemented, clayey, silty fine sand
5									more clay
		D1-3I	32						light grayish brown, slightly silty
15		D1-4I	31	97	3.3				
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 8

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ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA NO: 5373.04

DATE: 7/03

PLATE NO: 3

BORING NUMBER: D2
DATE DRILLED: 6/3/03
LOGGED BY: EW

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							CL		Light brown, fine sandy, silty clay
							ML		Light gray, slightly clayey silt
		D2-1I	28	89	18.9		CL		Brown, silty clay
5		D2-2I	50/5"				SM		Light grayish brown, variably cemented, silty fine sand
10		D2-3I	50/2"				ML		Gray, fine sandy, clayey silt
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 8

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ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA NO: 5373.04

DATE: 7/03

PLATE NO: 4

BORING NUMBER: D3
DATE DRILLED: 6/3/03
LOGGED BY: EW

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							CL		Brown, fine sandy, silty clay
		D3-1I	26	90	23.1				
							SM		Light brown, claycy, silty fine sand
5									
		D3-2I	70				ML		Light brown, fine sandy, clayey silt
10									
		D3-3I	69				ML		Light brown, very fine sandy silt
							SM		Light grayish brown, silty fine sand
15		D3-4I	40						slightly silty
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 8

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ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA NO: 5373.04

DATE: 7/03

PLATE NO: 5

BORING NUMBER: D4
DATE DRILLED: 6/3/03
LOGGED BY: EW

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0		D4-1I	14	109	14.0		CL		Brown, fine sandy, silty clay
									less clay
5		D4-2I	43	86	17.1		SM		Brown, slightly clayey, silty fine sand
10		D4-3I	50				ML		Light brown with reddish mottling, slightly clayey, fine sandy silt
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 8

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ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA NO: 5373.04

DATE: 7/03

PLATE NO: 6

BORING NUMBER: D5
DATE DRILLED: 6/3/03
LOGGED BY: EW

DRILL RIG/METHOD:
CME-55/6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							CL		Brown, variably cemented, fine sandy, silty clay
		D5-1I	45	109	14.0				more sand
5		D5-2I	50				ML		Light gray with reddish mottling, clayey, fine sandy silt
10							SM		Grayish brown, silty fine sand
		D5-3I	44	83	29.0		ML		Brown, clayey silt
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No. 8

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ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA NO: 5373.04

DATE: 7/03

PLATE NO: 7

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - clay mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand - clay mixtures
FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL > 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler

= Drive Sample: no recovery

= Initial Water Level

= Final Water Level

= Estimated or gradational material change line

= Observed material change line

Laboratory Tests

PI = Plasticity Index
EI = Expansion Index
UCC = Unconfined Compression Test
TR = Triaxial Compression Test
GR = Gradational Analysis (Sieve)
K = Permeability Test

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL	3" to No. 4	76.2 to 4.76
coarse (c)	3" to 3/4"	76.2 to 19.1
fine (f)	3/4" to No. 4	19.1 to 4.76
SAND	No. 4 to No. 200	4.76 to 0.074
coarse (c)	No. 4 to No. 10	4.76 to 2.00
medium (m)	No. 10 to No. 40	2.00 to 0.420
fine (f)	No. 40 to No. 200	0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

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ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA NO: 5373.04

DATE: 7/03

PLATE NO: 8

APPENDICES

APPENDIX A

APPENDIX A

A. GENERAL INFORMATION

The performance of a geotechnical engineering investigation of the site for the proposed Almond Ranch residential subdivision located east of Oly Lane, south of PFE Road in Placer County, California, was authorized by Mr. Jack Coulter on May 19, 2003. Authorization was for an investigation as described in our proposal letter dated April 25, 2003, sent to our client, Town Development of Sacramento, whose mailing address is 3050 Tilden Drive, Roseville, California 95661-7942; telephone (916) 782-1640; fax (916) 782-1810.

In performing this investigation, we made reference to a copy of an Assessor's parcel map provided by Town Development of Sacramento.

B. FIELD EXPLORATION

Five test borings were drilled on June 3, 2003 at the approximate locations indicated on Plate No. 2, utilizing a CME-55 truck-mounted drill rig. The borings were drilled to a maximum depth of approximately 16½ feet below existing grade using six-inch diameter solid flight helical augers. At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D., modified California sampler driven by a 140-pound free falling hammer. The number of blows of the hammer required to drive the 18-inch long sampler each 6-inch interval was recorded. The sum of the blows required to drive the sampler the lower 12-inch interval, or portion thereof, are designated the penetration resistance or "blow count" for that particular drive.

Immediately after recovery, the field engineer classified the soil and the ends of the tubes were sealed with plastic caps to preserve the natural moisture content. Bulk samples were collected of near-surface soils; the approximate locations of these samples are indicated on Plate No. 2. The samples were taken to our laboratory for additional soil classification and selection of samples for testing.

C. LABORATORY TESTING

Selected undisturbed soil samples were tested to determine dry unit weight (ASTM D2937) and natural moisture content (ASTM D2216).

One representative bulk sample was subjected to Expansion Index test (ASTM D4829). These test results are summarized on the attached Plate No. A1.

One representative bulk sample was subjected to a Resistance value test (CT 301). These test results are summarized on the attached Plate No. A2.

One near-surface soil sample was submitted to Sunland Analytical to determine the soil pH and minimum resistivity (CT 643), sulfate concentration (CT 417) and chloride concentration (CT 422). Results from these tests are included as Plate No. A3.

EXPANSION INDEX TEST RESULTS

UBC Standard No. 29-2

ASTM D4829

MATERIAL DESCRIPTION: Light brown, slightly sandy, silty clay

LOCATION: B2 (See Plate No. 2)

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index *
0-2'	12.6	25.3	103	64

CLASSIFICATION OF EXPANSIVE SOIL **

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	Low
51 - 90	**Medium**
91 - 130	High
Above 130	Very High

* Corrected to 50% Saturation

** From UBC Table 29-C

RESISTANCE VALUE TEST RESULTS
(California Test 301)

MATERIAL DESCRIPTION: Light brown, slightly sandy, silty clay

LOCATION: B2 (See Plate No. 2)

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (dial)	Expansion Pressure (psf)	R Value
1	110	17.3	287	16	69	18
2	112	16.4	398	46	199	32
3	114	15.4	518	87	377	45

R-Value at 300 psi exudation pressure = 19

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 06/13/2003
Date Submitted 06/09/2003

To: Troy Kamisky
Wallace-Kuhl & Associates,Inc.
3050 Industrial Blvd.
West Sacramento, Ca 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 5373.04\ALMOND RCH. Site ID : B-2.
Your purchase order number is 6348.
Thank you for your business.

* For future reference to this analysis please use SUN # 39538-76258.

EVALUATION FOR SOIL CORROSION

Soil pH	6.30		
Minimum Resistivity	1.15	ohm-cm (x1000)	
Chloride	100.9 ppm	00.01009	%
Sulfate	43.1 ppm	00.00431	%

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX B

APPENDIX B

EARTHWORK SPECIFICATIONS

ALMOND RANCH RESIDENTIAL SUBDIVISION

Oly Lane

Placer County, California

WKA No. 5373.04

PART 1: GENERAL

1.1 SCOPE

a. General Description

This item shall include all clearing of surface and subsurface structures, trees, brush and associated items; preparation of surfaces to be filled, filling, spreading, compaction, observation and testing of the fill; and all subsidiary work necessary to complete the grading of the building areas to conform with the lines, grades and slopes as shown on the accepted Drawings.

b. Geotechnical Engineer

Where specific reference is made to "Geotechnical Engineer" this designation shall be understood to include both the firm and the individual representatives of that firm.

1.2 PROTECTION

a. Adequate protection measures shall be provided to protect workmen and passers-by at the site. Adjacent property shall be fully protected throughout the operations.

b. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This

requirement shall apply continuously and shall not be limited to normal working hours.

c. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.

d. Surface drainage provisions shall be made during the period of construction in a manner to avoid creating a nuisance to adjacent areas.

e. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

1.3 GEOTECHNICAL REPORT

a. A Geotechnical Engineering Report (WKA No. 5373.04, dated July 8, 2003) has been prepared for this site by Wallace - Kuhl & Associates, Inc., Geotechnical Engineers of West Sacramento, California [(916) 372-1434]. A copy is available for review at the office of Wallace - Kuhl & Associates, Inc.

b. The information contained in this report was obtained for design purposes only. The Contractor is responsible for any conclusions he/she may draw from this report; should the Contractor prefer not to assume such risk, he/she should employ their own experts to analyze available information and/or to make additional borings upon which to base their conclusions, all at no cost to the Owner.

1.4 EXISTING SITE CONDITIONS

The Contractor shall be acquainted himself with all site conditions. If unshown active utilities are encountered during the work, the owner shall be promptly notified for instructions. Failure to notify will make the Contractor liable for damage to these utilities arising from Contractor's operations subsequent to the discovery of such unshown utilities.

1.5 SEASONAL LIMITS

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate that the moisture contents of the subgrade and fill materials are satisfactory.

PART 2: PRODUCTS

2.1 MATERIALS

a. All fill shall be of approved local materials from required excavations, supplemented by imported fill, if necessary. Approved local materials are defined as local granular soil free from significant quantities of rubble, rubbish and vegetation, and having been tested and approved by the Geotechnical Engineer prior to use. Clods, rocks or hard lumps exceeding four inches (4") in final size shall not be allowed in the upper two feet (2') of any fill placed in structural areas.

b. Imported fill materials shall be approved by the Geotechnical Engineer; they shall meet the above requirements; shall have plasticity indices not exceeding fifteen (15) when tested in accordance with ASTM D4318, an expansion indices not exceeding twenty (20) when tested in accordance with ASTM D4829, a resistance value of fifteen (15) or higher when tested in accordance with California Test 301; and, shall be of four-inch (4") maximum particle size.

c. Asphalt concrete, aggregate base, aggregate subbase, and other paving products shall comply with the appropriate provisions of the State of California (Caltrans) Standard Specifications, latest edition.

PART 3: EXECUTION

3.1 LAYOUT AND PREPARATION

Lay out all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection of utilities--all prior to beginning actual earthwork operations.

3.2 CLEARING, GRUBBING AND PREPARING BUILDING PADS AND PAVEMENT AREAS

a. All vegetation to be removed; remnants from existing residential improvements including, but not limited to, foundations, slabs, septic systems including leach fields, fencing, rubble, rubbish, demolition debris and loose and/or saturated materials shall be removed and disposed of so as to leave the areas that have been disturbed with a neat and finished appearance, free from unsightly debris. Excavations and depressions resulting from the removal of such items, as well as any existing excavations or loose soil deposits, as determined by the Geotechnical Engineer, shall be cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications. Water wells, septic tanks and leach fields shall be abandoned in accordance with Placer County Department of Environmental Health requirements.

b. The surfaces upon which fill is to be placed shall be plowed or scarified to a minimum depth of at least twelve inches (12"), additional scarification may be required to remove any observed roots. Subgrade preparation shall continue until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the selected equipment.

c. In areas that presently and previously supported structures, the existing grades shall be thoroughly ripped and cross-ripped to a depth of twelve inches (12") to help uncover and remove structure remnants, debris and rubble. The processed soil shall then be thoroughly moisture conditioned to at least the optimum moisture content

and uniformly compacted to at least ninety percent (90%) of the ASTM 1557 maximum dry density.

d. When the moisture content of the subgrade is below the optimum moisture content, water shall be added until the proper moisture content is achieved.

e. When the moisture content of the subgrade is too high to permit the specified compaction to be achieved, the subgrade shall be aerated by blading or other methods until the moisture content is satisfactory for compaction.

f. After the foundations for fill have been cleared, plowed, or scarified, they shall be disced or bladed until uniform and free from large clods, brought to the proper moisture content and compacted to not less than ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Test Method.

3.3 PLACING, SPREADING AND COMPACTING FILL MATERIAL

a. The selected fill material shall be placed in layers which when compacted shall not exceed six inches (6") in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to promote uniformity of material in each layer.

b. Engineered fill constructed on existing slopes steeper than six horizontal to one vertical (6:1) shall begin with a level bench constructed at the toe of the fill. Engineered fill constructed on existing slopes steeper than four horizontal to one vertical (4:1) shall be keyed into the hillside at the toe of the fill. Benches and keys shall be processed and constructed in accordance with the recommendations of the Geotechnical Engineering Report.

c. When the moisture content of the fill material is below the optimum moisture content, water shall be added until the proper moisture content is achieved.

d. When the moisture content of the fill material is too high to permit the specified degree of compaction to be achieved, the fill material shall be aerated by blading or other methods until the moisture content is satisfactory.

e. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to at least ninety percent (90%) of the maximum dry density as

determined by the ASTM D1557 Test Method. Compaction shall be undertaken with equipment capable of achieving the specified density and shall be accomplished while the fill material is at the required moisture content. Each layer shall be compacted over its entire area until the desired density has been obtained.

f. The filling operations shall be continued until the fills have been brought to the finished slopes and grades as shown on the accepted Drawings.

3.4 TESTING AND OBSERVATION

a. Grading operations shall be observed by the Geotechnical Engineer, serving as the representative of the Owner.

b. Field density tests shall be made by the Geotechnical Engineer after compaction of each layer of fill. Additional layers of fill shall not be spread until the field density tests indicate that the minimum specified density has been obtained.

c. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

d. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, the Contractor shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer and the Engineer. No deviation from the specifications shall be made except upon written approval of the Geotechnical Engineer or Engineer.

GEOTECHNICAL ENGINEERING REPORT

PFE 14 ACRES

WKA No. 5373.02

January 26, 2003

WALLACE · KUHL & ASSOCIATES INC.

WALLACE - KUHL & ASSOCIATES INC.

Geotechnical Engineering Report

PFE 14 ACRES

PFE Road

Placer County, California

WKA No. 5373.02

January 20, 2003

INTRODUCTION

General

This report presents the results of our geotechnical engineering investigation for the **PFE 14 Acre** property located on PFE Road, east of Cook-Riolo Road in Placer County, California. The purposes of our work have been to explore the site, soil and ground water conditions across the property, and to provide geotechnical engineering conclusions and recommendations regarding development of the property with a single-family residential subdivision.

Scope

Our scope of work has included the following tasks:

1. site reconnaissance;
2. review of historic USGS topographic maps and historical aerial photographs of the property;
3. subsurface investigation, including the drilling of three borings to a maximum depth of approximately 15 feet below the ground surface;
4. laboratory testing of selected soil samples; and,
5. engineering analyses and preparation of this report.

Our office has performed several geotechnical engineering investigations in the surrounding area. Site and soil-related information contained in those reports was used to assist in the preparation of this report.

Our office is currently preparing an Environmental Site Assessment of the subject property (WKA No. 5373.01). Pertinent information contained in that report also was used to assist in the preparation of this report.

CORPORATE OFFICE
3990 Industrial Boulevard
West Sacramento
CA 95691
Tel: 916.372.1480
Fax: 916.372.1485

ROCKLIN OFFICE
930 Roseville Road
Suite 200
Rocklin, CA 95765
Tel: 916.435.8122
Fax: 916.435.9827

STOCKTON OFFICE
3615 West Hammer Lane
Suite F
Stockton, CA 95219
Tel: 209.473.1700
Fax: 209.473.1707

Plates and Attachments

This report contains a Site Vicinity Map, Plate No. 1; a Boring Location Plan, Plate No. 2; and, Logs of Borings, Plates No. 3 through 5. An explanation of the symbols and classification system used on the logs is included as Plate No. 6. Appendix A contains general information regarding project concepts, exploratory methods used during our field investigation, and laboratory test results not shown on the logs. Appendix B contains earthwork specifications that may be used in the preparation of contract documents.

Proposed Development

Based on our conversations with County Builders, LLC, we understand the approximate 14 acre property will be developed with a residential subdivision consisting of one- and two-story, wood-frame houses with interior slab-on-grade lower floors. Building loads typical of ordinary residential construction are assumed for the houses. Additional improvements will consist of roadways and underground utility improvements.

Grading plans are not available, but we anticipate maximum excavations and fills to develop the site on the order of six to eight feet.

FINDINGS

Site Conditions

The subject property consists of gently to moderately rolling open grassland and an orchard, located just north of the Sacramento/Placer County line in Placer County, California. The property is bounded to the north by PFE Road; to the east by an open field; and, to the south and west by rural residences. Our review of historic aerial photographs and topographical maps indicates the property has remained relatively unchanged since the mid 1960's. Based upon the topography shown on the *USGS Topographic Map of the Citrus Heights Quadrangle, 1992*, site elevations range from approximately +120 feet to +140 feet relative to mean sea level (msl).

At the time of our field exploration, the surface of the site was covered with a low to moderate growth of grasses and weeds. A naturally occurring drainage swale (approximately 15 to 20 feet wide), formed from the runoff from the adjacent properties, extends along the western side of the property. Running water was observed in the drainage swale at the time of our field investigation on December 18, 2002. A rural residence is located near the southeast corner of the site. Mature trees and shrubs were observed at various locations across the site with higher concentrations near the northern and central portions of the property

Soil Conditions

The test borings revealed the upper one to three feet to consist of light brown, medium dense, fine sandy silts with traces of clay. Underlying the surface soils are alternating layers of light brown and brown, dense, silty fine sands and fine sandy silts to the maximum depth explored of 15 feet below existing site grades. These soils are sometimes slightly to well cemented.

Please refer to the Logs of Borings, Plates No. 3 through 5, for more detail regarding subsurface soil conditions at a particular location.

Ground Water

Free ground water was not encountered within the 15 foot maximum depth of our borings performed on December 18, 2002. The current Sacramento County ground water map (published Spring 2000) indicates that the ground water beneath the area of the subject property is located at an elevation of approximately -20 feet msl, or roughly 140 feet below the lowest existing site elevations.

CONCLUSIONS

Building Support

Field and laboratory test results indicate the undisturbed native soils are capable of supporting the proposed residential improvements. Clearing operations to remove trees and existing

structures likely will disturb the near-surface soils. Disturbed areas must be excavated to a firm base and the excavations backfilled with engineered fill to provide adequate and uniform support for site improvements. Our work indicates that engineered fill, properly placed and compacted in accordance with the recommendations of this report, will be capable of supporting the planned residential structures.

Excavation Conditions

The test borings were drilled with a John Deere Gator mounted drill rig, which encountered only moderate difficulty penetrating the on-site soils. Based upon this and our local experience, conventional grading and trenching equipment will be able to perform the excavations required at the site within the depths explored.

Excavations likely will stand at a near-vertical inclination for short periods of time, unless zones or pockets of clean cohesionless sands are encountered or the construction is performed during the rainy season. Excavations encountering perched water or saturated soils may slough or cave if left open for an extended period of time. Excavations entered by workers must conform to current Cal/OSHA requirements (i.e., sloped or braced shoring). Temporarily sloped excavations should be constructed no steeper than one horizontal to one vertical (1:1).

Expansive Soils

The borings revealed fine sandy silts at the surface. Laboratory tests indicate these soils have a very low expansion potential. In our opinion, these soils are not capable of developing significant swelling pressures due to increases in soil moisture content. However, our experience in the area suggests that potential expansive clays may present above the cemented strata. If expansive clay soils are encountered and utilized to construct building pads or are present within excavated areas of building pads, presaturation of the soils subgrade prior to floor slab placement and reinforcement of floor slabs will be required to minimize the effects of the expansive soils.

Pavement Subgrade Quality

Laboratory test results indicate the on-site fine sandy silts are moderately good quality materials (Resistance value of 39) for the support of asphalt concrete pavements. Based on our laboratory data and experience in the area, we have selected an R-value of 30 for design of pavements to account for probable variations in the soils that may be exposed at final subgrade elevation.

Fill Material Suitability

The on-site non-expansive soils encountered in our borings are considered suitable for use as engineered fill materials if they are free of debris and organic concentrations, and are at suitable moisture content. Special recommendations are contained in this report regarding the use of expansive clays in engineered fill.

Ground Water/Seasonal Moisture

In our opinion, a permanent ground water table should not be a significant factor in design, construction or performance of the proposed subdivision. However, during the winter and spring months, infiltrating surface run-off water will create saturated surface soil conditions due to the impervious nature of the underlying cemented soils. It is probable that grading operations attempted following the onset of winter rains and prior to prolonged drying periods will be hampered by high soil moisture contents. Such soils, intended for use as engineered fill, will require a prolonged period of dry weather and/or considerable aeration to reach a moisture content suitable for proper compaction.

Seismic Code Design

The entire State of California is considered to be subject to ground shaking from numerous active fault systems across the state. Based on tables provided in the 1997 edition of the Uniform Building Code (UBC), the proposed development has the following site characteristics. The site is located within Seismic Zone 3. The site soil conditions most closely approximate an S_D profile. The site is not located within 15 kilometers of an active or potentially active fault;

therefore, near-fault effects will not be a factor in seismic design, nor is a seismic source type assigned using the 1997 UBC.

Erosion and Winterization

The on-site soils generally consist of fine sandy silts and silty fine sands. In our opinion, the undisturbed soils and fill materials consisting of on-site soils may be susceptible to erosion by surface run-off that occurs during intense rainfall. As a minimum, erosion control measures including placement of straw bale sediment barriers or construction of silt filter fences in areas where surface run-off may be concentrated would be prudent. The project civil engineer should develop a site-specific erosion and sediment control plan based upon their site grading and drainage plan, and the anticipated construction schedule. The erosion and winterization measures contained in the publication *Erosion and Sediment Control Guidelines for Developing Areas of the Sierra Foothills and Mountains*, dated October 1991, would be appropriate for developing such a plan.

Soil Corrosion Potential

A sample of the near-surface soil was submitted to Sunland Analytical Labs for testing to determine pH, resistivity, sulfate and chloride concentrations to help evaluate the potential for corrosive attack upon buried structures. The test results for the sample revealed a minimum resistivity of 6970 ohm-centimeters (Ω-cm) with a soil pH of approximately 5.79. Sulfates were recorded at 3.2 parts per million (ppm) and chlorides at 7.3 ppm. Results of this testing are summarized on Plate No. A3 in Appendix A.

Published literature[1] suggests that a "corrosive area" is an area where the soil and/or water contains more than 500 parts per million (ppm) of chlorides, more than 200 ppm of sulfates, has a minimum resistivity of less than 1000 ohm-centimeters or has a pH of less than 5.5. Table 19-A-4 of the 1997 UBC, *Requirements for Concrete Exposed to Sulfate-Containing Solutions*, indicates the sulfate exposure for the samples tested are *Negligible*. Based on this criterion we did not encounter a corrosive area within the site for the samples tested. Ordinary Type I-II

[1] California Department of Transportation Corrosion Technology Section, Office of Materials and Foundations, *Interim Corrosion Guidelines For Foundation Investigations*, May 1999.

Portland cement is indicated to be suitable for use on this project, assuming a minimum cover is maintained over the reinforcement.

Wallace-Kuhl & Associates are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site, or to determine the need or design parameters for cathodic protection or grounding systems, a corrosion engineer should be consulted.

RECOMMENDATIONS

Grading plans for the project have not been developed yet; therefore, for the purposes of preparing this report we have assumed maximum excavations and fills of around six to eight feet to develop the site. Additionally, we assume that most of the building pads will be constructed using native, granular soils, and building foundations will bear in granular engineered fill or non-expansive native undisturbed soils. However, it is possible that some building pads may contain expansive clay soils. When building pads expose expansive clay soils, the clays should be removed and replaced with granular engineered fill, or the building pads will be designated as expansive which will require special moisture conditioning prior to slab placement.

We should review the final grading plans to verify that the recommendations of our report remain applicable.

Site Clearing

Prior to site grading, the site should be cleared of surface and subsurface structures associated with current and past development of the site, including all foundations, concrete slabs, and underground utilities designated to be removed or relocated, including trench backfill. The site should be cleared of any concrete rubble and any deleterious debris. Trees designated for removal should include the entire rootball and all roots larger than ½-inch in diameter.

Loose or saturated soils within the drainage swale should be removed to expose firm undisturbed soils. The bid documents should include a unit cost (per cubic yard) for removal of loose or saturated soils and replacement as engineered fill.

On-site septic tanks, leach fields and domestic wells should be abandoned in accordance with Placer County Environmental Management Department requirements. Depressions resulting from the removal of the above items, as well as any loose, soft or saturated soils should be cleaned out to firm native soils and backfilled with engineered fill in accordance with the recommendations in this section.

Remaining surface vegetation should be removed by stripping. Strippings should be removed from the site or used as fill only in backyard areas. Strippings used in backyards should be kept at least five feet horizontally from the building pads. Strippings should be moisture conditioned, not exceed a vertical thickness of two feet, and receive reasonable compactive effort.

Discing may be a suitable alternate to stripping, depending upon the quantity and condition of the organics at the time of grading. Discing should only be allowed with our approval after review of the site conditions at the time of grading.

Site Preparation and Engineered Fill Construction

After clearing and organic removal are completed to the satisfaction of our representative, the exposed soils in areas to receive fill and at-grade areas should be scarified to a depth of at least 12 inches, moisture conditioned to the optimum moisture content or above and compacted to at least 90 percent of the maximum dry density per ASTM D1557. Deeper scarification may be required, depending upon the depth of soil disturbance observed by our representative. Our representative will determine the need for the deeper scarification.

On-site soils are considered suitable for use in engineered fill construction, if free of significant concentrations of organic material, rubble or debris. Imported fill materials should be granular materials with non-plastic fines (Plasticity Index of 15 or less, Expansion Index of 20 or less and R-value of at least 30), be free of particles greater than four inches in largest dimension. Imported soils must be approved by our office prior to being transported to the project site. Clay soils, exposed during site excavations may be used in deeper fills at the site, but should be excluded from the upper foot of building pad fills, when possible.

Engineered fill should be placed in lifts not exceeding six inches in compacted thickness, with each lift being uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 90 percent relative compaction. Clay soils used in fill construction should be moisture conditioned to at least two percent above the optimum moisture content. All compaction should be based on the ASTM D1557 test standard.

The upper six inches of soil subgrade in pavement areas should be uniformly moisture conditioned to at least the optimum moisture content and compacted to at least 95 percent relative compaction.

Lots achieved by excavation should be observed by our representative to determine if clay soils are present. Expansive clay soils exposed at or within 12 inches of final building pad elevation should be removed and replaced with on-site granular soils placed and compacted as engineered fill. The bid documents should include a per yard unit price for additional excavation and replacement with engineered fill. If the clay soils are not removed from building pad subgrades, or if clays are used for fill within the upper foot of the building pads, such building pads will be designated as expansive and will require special foundation and slab construction recommendations.

Site preparation should be accomplished in accordance with the recommendations of this section and the appended Earthwork Specifications (Appendix B). *It is essential that our representative be regularly present during the excavation, scarification and compaction operations to evaluate the proper compaction of the materials. Our representative also should be present throughout grading operations to observe and test the fill materials, as necessary.*

Foundation Design

One- and two-story residential structures may be supported upon continuous and isolated spread foundations that extend at least 12 inches into the compacted building pad, as measured from lowest adjacent soil grade. For this project, the building pad subgrade is defined as the soil surface on which capillary break gravel is placed. A continuous, reinforced foundation should be utilized for the perimeter of the structures to act as a "cut-off" to help minimize moisture infiltration and variations beneath the slab-on-grade areas of the structures. Continuous

foundations should be at least 12 inches wide; isolated spread foundations should maintain a minimum 18-inch dimension.

Foundations bearing in undisturbed or recompacted native soils, engineered fill, or a combination of these materials may be sized for vertical loads utilizing maximum allowable soil bearing pressures of 1500 per square foot (psf) for dead load, 2250 psf for dead plus live load or 3000 psf for total load, including the effects of seismic or wind forces. The weight of foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations.

We recommend that all foundations be adequately reinforced to provide structural continuity, mitigate cracking and permit spanning of local soil irregularities. The structural engineer should determine the foundation reinforcing requirements. However, *as a minimum*, we recommend that continuous foundations be reinforced with at least two No. 4 steel reinforcing bars, placed one each, near the top and bottom of the foundations.

Resistance to lateral displacement of shallow foundations may be computed using an allowable friction factor of 0.30 multiplied by the effective vertical load on each foundation. Additional lateral resistance may be achieved using an allowable passive earth pressure against the vertical projection of the foundation equal to an equivalent fluid pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since mobilization of the passive resistance requires some horizontal movement, effectively reducing the frictional resistance.

Interior Floor Slab Support

Non-Expansive Building Pads

Concrete slabs-on-grade may be suitably supported upon soil subgrades prepared in accordance with the recommendations in this report. Interior concrete slab-on-grade floors should be at least four inches thick; the structural engineer should determine final slab thickness and reinforcing based upon the anticipated floor loads. From a crack-control standpoint, a light gauge 6x6/W1.4xW1.4 welded wire fabric (in rolls) would be suitable for slab reinforcement; however, it has been our experience that it is more difficult to consistently locate the lighter gauge wire

mesh at mid-slab depth. Accurate and consistent location of the reinforcement at mid-slab is essential to its performance and the risk of uncontrolled drying shrinkage slab cracking is increased if the reinforcement is not properly located within the slab. Therefore, we recommend consideration should be given to using a heavier gauge 6x6/W2.9xW2.9 wire (flat sheets) placed on chairs, or No. 3 rebar at 24-inches each way in the slab.

The recommendations presented above are provided to help minimize soil-related cracking of slab-on-grade floors. Equally important to the performance and appearance of Portland cement concrete slabs is the quality of the concrete, the skill of the concrete contractor, curing techniques utilized and the spacing of control joints.

Interior floor slabs may be underlain by a layer of free-draining gravel, serving as a deterrent to migration of capillary moisture. The gravel layer should be at least four inches thick, and should be graded such that 100 percent passes a one-inch sieve and none passes a No. 4 sieve. Additional moisture protection may be provided by placing a sheet plastic membrane (10-mil or thicker) directly over the gravel. An optional, thin layer of clean sand above the membrane is acceptable, as an aid to curing of the slab concrete.

Expansive Building Pads

Slabs constructed on expansive soils should contain *at least* 6x6/W2.9xW2.9 welded wire mesh reinforcement or No. 3 rebar located on maximum 18-inch centers each way throughout the slab, to help minimize the effects of expansive clays. Location of the reinforcement at mid-slab is essential to its performance. Floor slabs constructed on expansive soils must have the upper 12 inches of the soil subgrade brought to a near-saturated condition prior to concrete slab placement. Adequate moisture conditioning must be verified by our office within 48 hours prior to slab placement. Use of the vapor barrier membrane is considered essential when presaturation is accomplished.

Floor Slab Moisture Penetration Resistance

It is considered likely that floor slab subgrade soils will become wet to near-saturated at some time during the life of the structures. This is a certainty when slabs are constructed during the wet seasons, when the pads are moisture conditioned prior to slab construction, or when

constantly wet ground or poor drainage conditions exist adjacent to structures. For this reason, it should be assumed that all slabs in living areas, as well as those intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. Standard practice includes the gravel, plastic membrane and sand as suggested above. However, the gravel and plastic membrane offer only a limited, first line of defense against soil-related moisture. Recommendations contained in this report concerning foundation and floor slab design are presented as *minimum* requirements, only from the geotechnical engineering standpoint.

It is emphasized that we are not slab moisture-proofing or moisture protection experts. We are expressly stating that we make no guarantee nor provide any assurance that use of the sub-slab gravel and sheet plastic will reduce slab moisture penetration to any specific amount or level, particularly those required by floor covering manufacturers. The builder and designers should consider all available measures for slab moisture protection. It is commonly accepted that the quality and thickness of the concrete slab are of primary importance to reducing moisture and moisture vapor penetration.

Exterior Concrete Flatwork

Areas to receive exterior flatwork (sidewalks, patios, etc.) should be thoroughly moisture conditioned and properly compacted prior to placement of concrete. Uniform moisture conditioning of subgrade soils is important to reduce the risk of non-uniform moisture withdrawal from the concrete and the possibility of plastic shrinkage cracks. Practices recommended by the Portland Cement Association for proper placement and curing of concrete should be followed during exterior concrete flatwork construction. Flatwork should be independent of the building foundations and felt strips should be used to separate concrete slabs from adjacent existing concrete structures.

Trench Backfill

All utility trench backfill should be mechanically compacted in maximum 12-inch thick lifts to at least 90 percent of maximum dry density. We recommend that only native soils be used as

trench backfill within the perimeter of the building foundations to help minimize soil moisture variations beneath the structure. The native soil backfill should extend at least three feet beyond perimeter foundation lines. **Jetting is not recommended for compaction of utility trench backfill.**

Utility trench backfill and compaction, and pipe bedding and initial backfill of utility lines within County right-of-ways should conform with Placer County Standards and the pipe manufacturers recommendations.

Site Drainage

Final site grading should be accomplished to provide positive drainage of surface water away from the buildings and prevent ponding of water adjacent to foundations. The grade adjacent to the structures should be sloped away from the foundations at a minimum two percent slope for a distance of at least five feet, where possible. Roof gutter downspouts and surface drains should be connected to solid PVC piping and directed towards appropriate drainage facilities, or the downspouts should drain onto concrete surfaces sloping away from the structures.

Pavement Design

Based on Resistance ("R") value testing, our experience in the area, and using a range of design traffic indices, we have calculated pavement section alternatives for a Resistance-value of 30. The procedures used for designing the pavement section are in general conformance with the "Flexible Pavement Structural Design Guide for California Cities and Counties" and applicable portions of the Caltrans Highway Design Manual. The project civil engineer should select the appropriate pavement sections based upon Placer County requirements.

PAVEMENT DESIGN ALTERNATIVES R-value = 30		
Traffic Index (TI)	Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
5.0	2½	7
	3*	6
5.5	2½	8
	3*	7
6.0	3	9
	3½*	8
6.5	3	10
	3½*	9
9.0	4½	15
	5½*	13

* includes the Caltrans factor of safety applied to the asphalt concrete thickness

We emphasize that pavement performance is critically dependent upon adequate and uniform compaction of the subgrade soils, as well as all engineered fill and utility trench backfill within the limits of the pavements. The upper six inches of pavement soil subgrade should be compacted to at least 95 percent relative compaction at a moisture content of at least the optimum moisture. Aggregate base should be compacted to at least 95 percent maximum dry density.

Materials quality and construction within the structural sections should comply with Placer County Standards and applicable provisions of the Caltrans Standard Specifications.

Construction Testing and Observation

Geotechnical testing and observation services during construction is considered a continuation of our geotechnical engineering investigation. Wallace - Kuhl & Associates, Inc. should be retained to provide testing and observation services during site grading, and foundation and pavement construction. In addition, it is recommended that WKA be retained to check compliance with design concepts and project specifications, and to provide consultation as required during construction.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by field exploration and laboratory testing programs. We performed our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed by members of our profession practicing in the Sacramento Valley area. If the proposed construction is modified, resited, or if it is found during construction that subsurface conditions differ from those we encountered at our test boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We recommend our firm be given the opportunity to review the final plans and specifications to determine if our recommendations have been implemented in those documents.

We emphasize that this report is applicable only to the proposed construction and the investigated site. This report should not be utilized for construction on any other site.

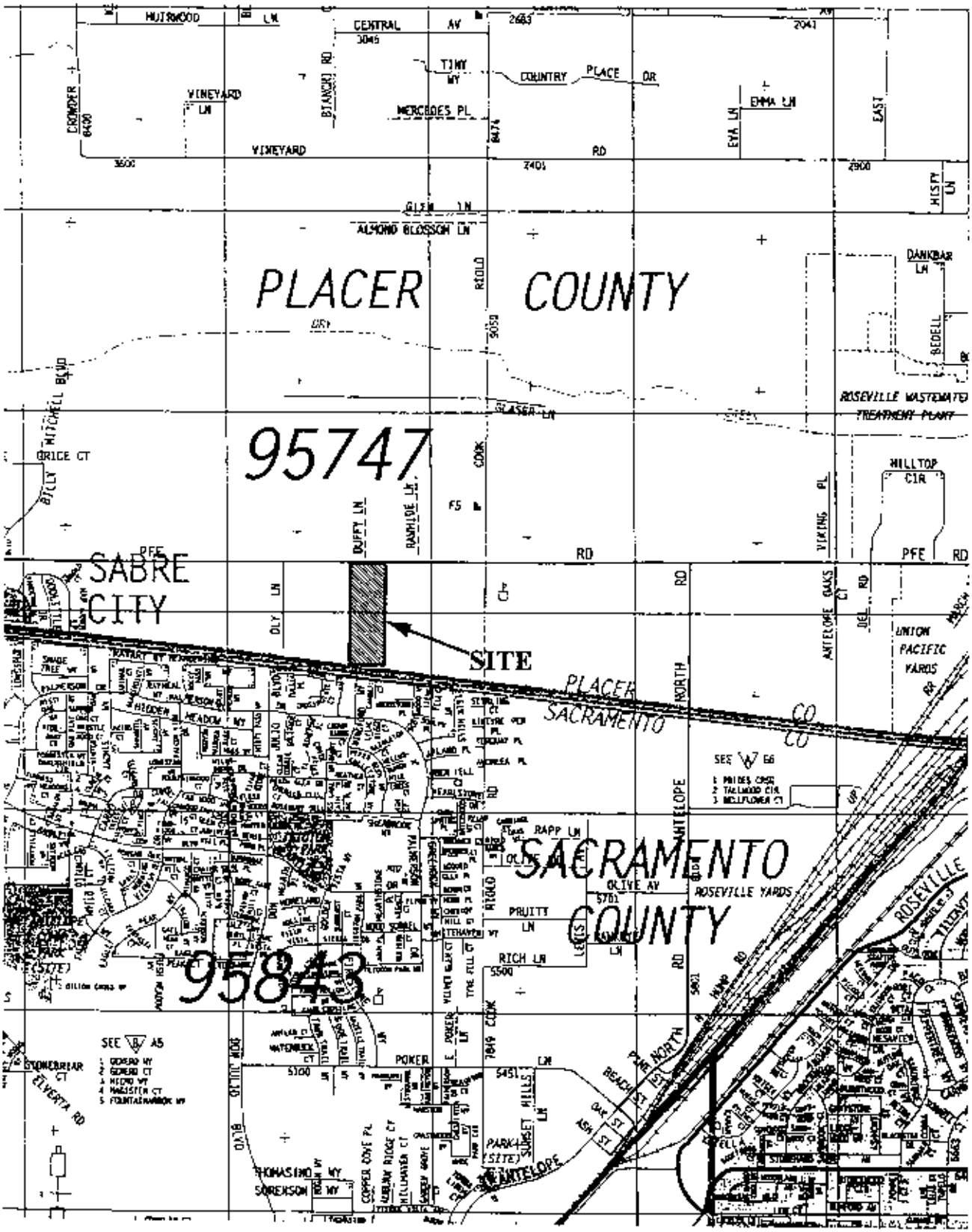
Wallace - Kuhl & Associates, Inc.

Troy W. Kamisky
Staff Engineer

Stephen L. French
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
STEPHEN L. FRENCH
No. 323
Exp. 3-31-06
GEOTECHNICAL
STATE OF CALIFORNIA

TWK: SLF



Adapted from the Thomas Guide
Sacramento and Solano Counties
Street Guide and Directory, 2001 edition.

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PFE 14 ACRES

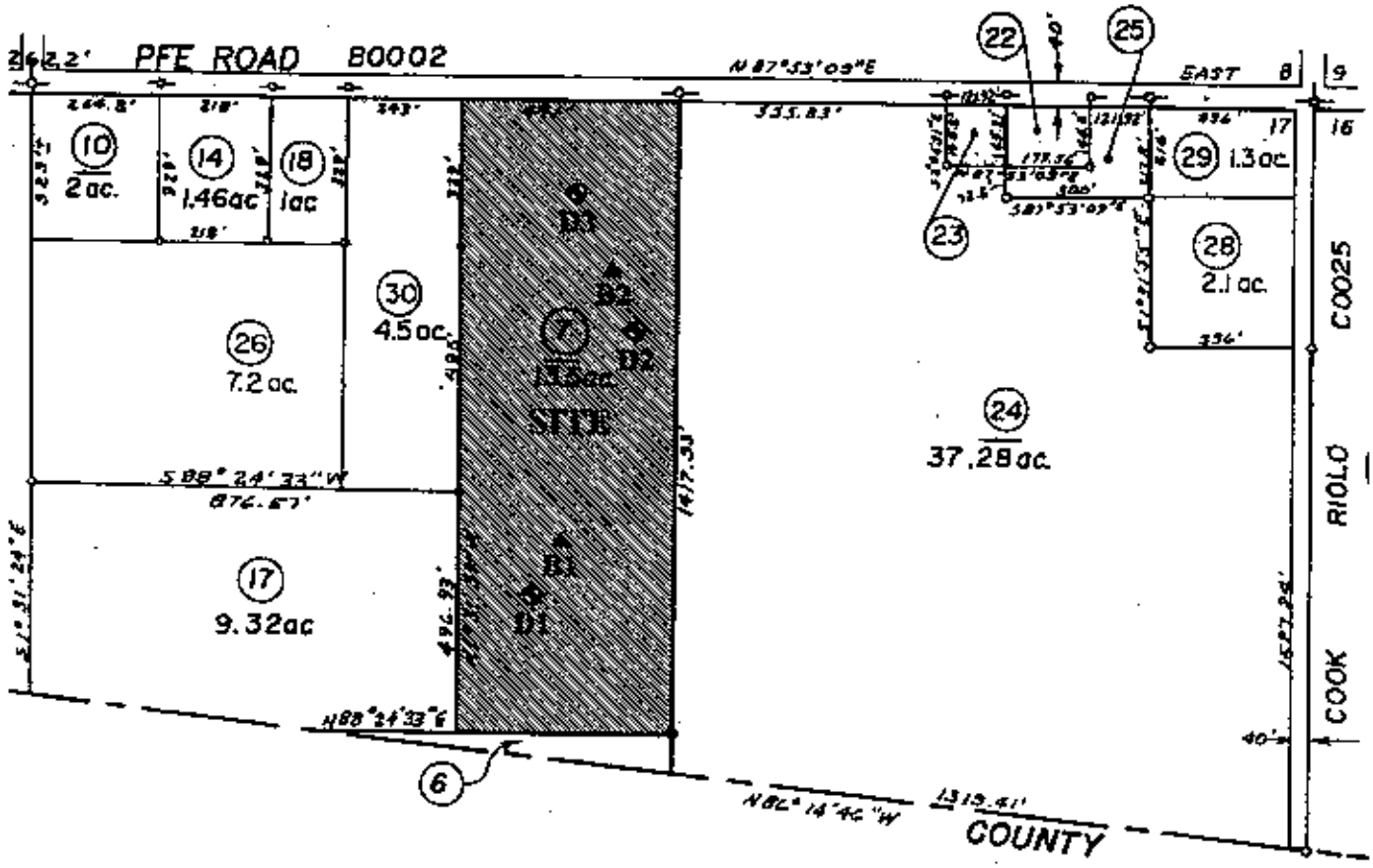
PFE Road

Placer County, California

WKA NO: 5373.02

DATE: 1/03

PLATE NO: 1



Legend:

- ◆ -Approximate soil boring location
- ▲ -Approximate bulk sample location

Adapted from the Sacramento County Assessor's Map Book 23, Page 26.

0 200 400
Scale in Feet

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PFE 14 ACRES

PFE Road

Placer County, California

WKA NO: 5373.02

DATE: 1/03

PLATE NO: 2

BORING NUMBER: D1
DATE DRILLED: 12/18/02
LOGGED BY: WAN

DRILL RIG/METHOD:
GIDDINGS JD 4x6¼-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, fine sandy silt
		D1-1I	9	110	16.7				
5		D1-2I	27	93	15.6				
							SM		Light brown, silty fine sand variable cemented brown
10									
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No.
4. Blow counts relate to 70 pound hand operated hammer and 18 inch drop.

BORING NUMBER: D2
DATE DRILLED: 12/9/02
LOGGED BY: TWK

DRILL RIG/METHOD:
CME-55\6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, clayey, fine sandy silt
		D2-1I	50	114	12.3		SM		Light brown, silty fine sand variable cemented
5									
		D2-2I	40/8"	86	6.9		ML		Light brown, slightly fine sandy silt
10									
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No.
4. Blow counts relate to 70 pound hand operated hammer and 18 inch drop.

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GEOLOGIC & ENVIRONMENTAL SERVICES

PFE 14 ACRES

PFE Road

Placer County, California

WKA NO: 5373.02

DATE: 1/03

PLATE NO: 4

BORING NUMBER: D3
DATE DRILLED: 12/9/02
LOGGED BY: TWK

DRILL RIG/METHOD:
CME-55\6-INCH
SOLID FLIGHT AUGERS

DEPTH (feet)	SAMPLER	SAMPLE NUMBER	BLOWS/FT.	DRY UNIT WT. (PCF)	MOISTURE CONTENT (%)	OTHER TESTS	USCS	GRAPHIC LOG	SOIL DESCRIPTION AND REMARKS
0							ML		Brown, clayey, fine sandy silt
		D3-11	14	105	17.9				
							SM		Light brown, silty fine sand
5									variable cemented
10									
15									
20									

Notes:

1. This log depicts conditions only at the boring location, see Plate No. 2, and only on the date of field exploration.
2. Ground water was not encountered in the boring.
3. For an explanation of the symbols used in the boring log, see Plate No.
4. Blow counts relate to 70 pound hand operated hammer and 18 inch drop.

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GEOLOGIC & ENVIRONMENTAL SERVICES

PFE 14 ACRES

PFE Road

Placer County, California

WKA NO: 5373.02

DATE: 1/03

PLATE NO: 5

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - clay mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand - clay mixtures
FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL ≥ 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler

= Drive Sample: no recovery

= Initial Water Level

= Final Water Level

= Estimated or gradational material change line

= Observed material change line

Laboratory Tests

PI = Plasticity Index
EI = Expansion Index
UCC = Unconfined Compression Test
TR = Triaxial Compression Test
GR = Gradational Analysis (Sieve)
K = Permeability Test

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

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GEOTECHNICAL ENGINEERING
GEOLOGIC & ENVIRONMENTAL SERVICES

PFE 14 ACRES

PFE Road

Placer County, California

WKA NO: 5373.02

DATE: 1/03

PLATE NO: 6

APPENDIX A

APPENDIX A

A. GENERAL INFORMATION

The performance of a geotechnical engineering investigation of the site for the proposed PFE 14 Acres residential subdivision located south of PFE Road, west of Cook-Riolo Road in Placer County, California, was authorized by Mr. Jack Coulter on November 26, 2002. Authorization was for an investigation as described in our proposal letter dated November 19, 2002, sent to our client, County Builder, LLC, whose mailing address is 3050 Tilden Drive, Roseville, California 95661-7942; telephone (916) 782-1640; fax (916) 782-1810.

In performing this investigation, we made reference to a copy of a parcel map provided by County Builders, LLC.

B. FIELD EXPLORATION

Three test borings were drilled on December 18, 2002 at the approximate locations indicated on Plate No. 2, utilizing a John Deere Gator-mounted drill rig. The borings were drilled to a maximum depth of approximately 15 feet below existing grade using four-inch diameter continuous flight helical augers. At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D., California sampler driven by a 70 pound hand-driven hammer. The number of blows of the hammer required to drive the 12-inch long sampler each 6-inch interval was recorded. The sum of the blows required to drive the sampler the 12-inch interval, or portion thereof, are designated the penetration resistance or "blow count" for that particular drive.

Immediately after recovery, the field engineer classified the soil and the ends of the tubes were sealed with plastic caps to preserve the natural moisture content. Bulk samples were collected of near-surface soils; the approximate locations of these samples are indicated on Plate No. 2. The samples were taken to our laboratory for additional soil classification and selection of samples for testing.

C. LABORATORY TESTING

Selected undisturbed soil samples were tested to determine dry unit weight (ASTM D2937) and natural moisture content (ASTM D2216).

One representative bulk sample was subjected to a Resistance value test (CT 301) and an Expansion Index test (ASTM D4829). These test results are summarized on the attached Plates No. A1 and A2.

One near-surface soil sample was submitted to Sunland Analytical to determine the soil pH and minimum resistivity (CT 643), sulfate concentration (CT 417) and chloride concentration (CT 422). Results from these tests are included as Plate No. A3.

EXPANSION INDEX TEST RESULTS

UBC Standard No. 29-2

ASTM D4829-88

MATERIAL DESCRIPTION: Brown, fine sandy silt

LOCATION: B1

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index *
0-2'	8.7	17.9	110.4	**17**

CLASSIFICATION OF EXPANSIVE SOIL **

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	**Very Low**
21 - 50	Low
51 - 90	Medium
91 - 130	High
Above 130	Very High

* Corrected to 50% Saturation

** From UBC Table 29-C

RESISTANCE VALUE TEST RESULTS
(California Test 301)

MATERIAL DESCRIPTION: Brown, fine sandy silt

LOCATION: B1 (0-2')

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (dial)	Expansion Pressure (psf)	R Value
1	118	12.9	183	9	39	15
2	121	12.0	303	25	108	39
3	122	11.1	438	39	169	56

R-Value at 300 psi exudation pressure = 39

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 01/03/2003
Date Submitted 12/31/2002

To: Troy Kamisky
Wallace-Kuhl & Associates,Inc.
3050 Industrial Blvd.
West Sacramento, Ca 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 5373.02\PFE 14 ACRES Site ID : B1.
Your purchase order number is 5146.
Thank you for your business.

* For future reference to this analysis please use SUN # 38624-74430.

EVALUATION FOR SOIL CORROSION

Soil pH	5.79		
Minimum Resistivity	6.97 ohm-cm (x1000)		
Chloride	7.3 ppm	00.00073	%
Sulfate	3.2 ppm	00.00032	%

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

APPENDIX B

APPENDIX B

EARTHWORK SPECIFICATIONS

PFE 14 ACRES

PFE Road

Placer County, California

WKA No. 5373.02

PART 1: GENERAL

1.1 SCOPE

a. General Description

This item shall include all clearing of surface and subsurface structures, trees, brush and associated items; preparation of surfaces to be filled, filling, spreading, compaction, observation and testing of the fill; and all subsidiary work necessary to complete the grading of the building areas to conform with the lines, grades and slopes as shown on the accepted Drawings.

b. Geotechnical Engineer

Where specific reference is made to "Geotechnical Engineer" this designation shall be understood to include both the firm and the individual representatives of that firm.

1.2 PROTECTION

a. Adequate protection measures shall be provided to protect workmen and passers-by the site. Adjacent property shall be fully protected throughout the operations.

b. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

c. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.

d. Surface drainage provisions shall be made during the period of construction in a manner to avoid creating a nuisance to adjacent areas.

e. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

1.3 GEOTECHNICAL REPORT

a. A Geotechnical Engineering Report (WKA No. 5373.02, dated January 20, 2002) has been prepared for this site by Wallace - Kuhl & Associates, Inc., Geotechnical Engineers of West Sacramento, California [(916) 372-1434]. A copy is available for review at the office of Wallace - Kuhl & Associates, Inc.

b. The information contained in this report was obtained for design purposes only. The contractor is responsible for any conclusions he may draw from this report; should he prefer not to assume such risk, he should employ his own experts to analyze available information and/or to make additional borings upon which to base his conclusions, all at no cost to the Owner.

1.4 EXISTING SITE CONDITIONS

The Contractor shall acquaint himself with all site conditions. If unshown active utilities are encountered during the work, the owner shall be promptly notified for instructions. Failure to notify will make the Contractor liable for damage to these utilities arising from Contractor's operations subsequent to his discovery of such unshown utilities.

1.5 SEASONAL LIMITS

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate that the moisture contents of the subgrade and fill materials are satisfactory.

PART 2: PRODUCTS

2.1 MATERIALS

a. All fill shall be of approved local materials from required excavations, supplemented by imported fill, if necessary. Approved local materials are defined as local granular soil free from significant quantities of rubble, rubbish and vegetation, and having been tested and approved by the Geotechnical Engineer prior to use. Clods, rocks or hard lumps exceeding four inches (4") in final size shall not be allowed in the upper two feet (2') of any fill placed in structural areas.

b. Imported fill materials shall be approved by the Geotechnical Engineer; they shall meet the above requirements; shall have plasticity indices not exceeding fifteen (15), an expansion indices not exceeding twenty (20), a resistance value of thirty (30) or higher; and, shall be of four-inch (4") maximum particle size.

c. Asphalt concrete, aggregate base, aggregate subbase, and other paving products shall comply with the appropriate provisions of the State of California (Caltrans) Standard Specifications, dated July 1992.

PART 3: EXECUTION

3.1 LAYOUT AND PREPARATION

Lay out all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection of utilities--all prior to beginning actual earthwork operations.

3.2 CLEARING, GRUBBING AND PREPARING BUILDING PAD, AND PAVEMENT AREAS

a. All vegetation to be removed; remnants from existing residential improvements including, but not limited to, foundations, slabs, septic systems including leach fields, fencing, rubble, rubbish, demolition debris and loose and/or saturated materials shall be removed and disposed of so as to leave the areas that have been disturbed with a neat and finished appearance, free from unsightly debris. Excavations and depressions resulting from the removal of such items, as well as

any existing excavations or loose soil deposits, as determined by the Geotechnical Engineer, shall be cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications. Water wells, septic tanks and leach fields shall be abandoned in accordance with Placer County Department of Environmental Health requirements.

b. The surfaces upon which fill is to be placed shall be plowed or scarified to a minimum depth of at least twelve inches (12"), additional scarification may be required to remove any observed roots. Subgrade preparation shall continue until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the selected equipment.

c. When the moisture content of the subgrade is below the optimum moisture content, water shall be added until the proper moisture content is achieved.

d. When the moisture content of the subgrade is too high to permit the specified compaction to be achieved, the subgrade shall be aerated by blading or other methods until the moisture content is satisfactory for compaction.

e. After the foundations for fill have been cleared, plowed, or scarified, they shall be disced or bladed until uniform and free from large clods, brought to the proper moisture content and compacted to not less than ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Compaction Test.

3.3 PLACING, SPREADING AND COMPACTING FILL MATERIAL

a. The selected fill material shall be placed in layers which when compacted shall not exceed six inches (6") in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to promote uniformity of material in each layer.

b. When the moisture content of the fill material is below the optimum moisture content, water shall be added until the proper moisture content is achieved.

c. When the moisture content of the fill material is too high to permit the specified degree of compaction to be achieved, the fill material shall be aerated by blading or other methods until the moisture content is satisfactory.

d. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to at least ninety percent (90%) as determined by the ASTM D1557 Compaction Test. Compaction shall be undertaken with equipment capable of achieving the specified density and shall be accomplished while the fill material is at the required moisture content. Each layer shall be compacted over its entire area until the desired density has been obtained.

e. The filling operations shall be continued until the fills have been brought to the finished slopes and grades as shown on the accepted Drawings.

3.4 TESTING AND OBSERVATION

a. Grading operations shall be observed by the Geotechnical Engineer, serving as the representative of the Owner.

b. Field density tests shall be made by the Geotechnical Engineer after compaction of each layer of fill. Additional layers of fill shall not be spread until the field density tests indicate that the minimum specified density has been obtained.

c. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

d. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer and the Engineer. No deviation from the specifications shall be made except upon written approval of the Geotechnical Engineer or Engineer.

/